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# READING WHAT FARMERS WRITE

## An agroecological exploration of three farmers/authors' proposals to develop ecological, productive and profitable farm enterprises.

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Cows, sheep and hens at Ridgedale Permaculture. Photo credit: author

Broilers in pens at Ridgedale Permaculture. Photo credit: author

Hens and eggmobil at Ridgedale Permaculture. Photo credit: author

## Abstract

*Writings of successful 'alternative' farmers have generated much interest among aspiring farmers, media and the general public. Research in food systems, however, seems to have paid little attention to such cases. Should researchers be looking more closely at these approaches?*

*This thesis uses a Case Study Analysis to explore the accounts and proposals of three farmer-authors – Joel Salatin, Mark Shepard and Richard Perkins. The analysis of the first two is based in the authors' books, articles and interviews available online, while the third is also based in participant observation and semi-structured interviews. As the use of sustainability as an all-encompassing concept often muddles discussions, this study used a different method, analyzing these approaches in light of how desirable they are, how they sustain the resources they require, and their potential and appeal for broad adoption.*

*These approaches were found to be generally in line with agroecological principles and likely to be among the best in various aspects of desirability and sustainability. Although they are knowledge intensive, they use low capital approaches which may ease their adoption. Moreover, they convey narratives that weave elements of entrepreneurship, ethics and personal fulfillment that are little studied in agroecological literature.*

*Although solid conclusions require more detailed research, these models appear to be good prototypes for a return to highly diversified multi-purpose farms. Useful next steps include researching the actual values of their productivity and profitability, the extent of potential market for similar models, and how to develop the know-how required to make such farms work.*

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## PREFACE

Two years ago I applied to the MSc. in Agroecology at NMBU, driven by the desire to learn how to change rural areas into more productive, enjoyable and ecologically sound ecosystems. During the program I changed many of the points of view I held, but that objective remained constant. This thesis is above all a search for a compelling an enduring agriculture that I can advocate and propagate.

That is not an easy search. The world is changing faster every year and the more I know, the more I know how little I know. I don't think it is possible to rely on empirical findings ("facts") alone – there are too many to be carefully considered and it is hard to divide reasoned and well-intended arguments from simplistic and self-serving ones. Hence this thesis is also part of a personal search for a moral and practical compass that can guide thought and action in human endeavors in general and in agriculture and food systems in particular.

But this thesis is not for myself only. I believe that my desire to have a farm that heals nature and creates fulfilling jobs is shared by many. We have all heard stories of farmers trying to conciliate production and environment in inspiring ways, but are often skeptical of their clams or unsure about how to start. This thesis explores their approaches to start and run a farm to see if they provide sound advice to people wanting to begin farming based on solid ethical and ecological principles.

## ACKNOWLEDGEMENTS

*Though only my name appears on the cover, this thesis would not have been possible without the support of several people.*

*I would like send my thank you to my thesis supervisors, Tor Arvid Breland and Charles Francis for their encouragement and guidance;*

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*Sweden, 17th of May 2016*
*José Domingues Costa*

# 1.INTRODUCTION

## CONTEXT AND REASONS TO STUDY THIS SUBJECT

Today we live in a world that greatly differs from that our parents or grandparents were born into. It is much fuller with people, who affect the resources and processes of the planet[1–3] at a scale much greater than any time in the past.

The tremendous growth in population of the XX century was made possible by advances in sanitation, medicine, and the application of new technologies to food production. With many achievements and opportunities also came many problems and threats. These are often diffuse or imperceptible, such as ecological impoverishment, pollution, climate change[4] and new economic, social and political challenges[5].

Industrial agriculture is a pillar of modern life but also a major cause of social and ecological problems. Many still defend that this model can be reformed and improved through technology, either by substituting inputs, increasing operational efficiency or using transgenic modification[6–8]. Proponents of alternative models, however, argue that a more profound redesign of food systems is not only necessary, but possible[9–12]. These ideas are in turn rejected by the first group as not productive or economically viable to account for a substantial portion of the food production.[8,13]

While the academic debate rages on, some farmers persevered in their convictions that a different and much better agriculture – productive, profitable, enjoyable and ecologically responsible – is possible. An increasing number of these farmers are writing books and talking their approaches and experiences.

In the U.S., Joel Salatin has written about pasture-based enterprises[14,15], what it takes for a farm entrepreneur to succeed[16] and the problems and solutions of America's food system[17,18]. Mark Shepard argues that agroforestry-based farms can restore ecosystems and profitably provide the nutrition humans require[19]. Eliot Coleman[20] and others[21–23] have written about making a living with small scale, diverse vegetable production. In Sweden, Richard Perkins is finalizing a book on how to start and succeed with small farms.

These authors have generated interest, debate, and inspiration for many aspiring farmers. However, they seem to have gotten less attention by agroecologists – searches on ISI's Web of knowledge (conducted on 21/03/2016 between 18:00 and 19:00) yielded two articles referring 'Joel Salatin' and none for the other authors This is intriguing as their proposals appear to have much in common. Are their claims just the hopes of dreamers, the product of favorable conditions, or are they indeed on to something? That is the main subject of this thesis.

## BRIEF REVIEW OF SUSTAINABILITY AND ALTERNATIVE AGRICULTURE MODELS

### Sustainability and 'sustainable agriculture'

The concept of 'sustainable agriculture' was coined in 1983 by Wes Jackson, although proposals for alternatives to the conventional model existed for decades[24,25]. While such views were dismissed by the establishment before[25], the need for changes is at last receiving widespread recognition and acceptance[26,27]. If there is some agreement on the symptoms, the opinions on causes and possible cures are often contradictory[9,12], which reflects different motivations and worldviews[13,28].

The 1987 U.N. report "Our Common Future" defined *sustainable development* as that which *"meets the needs of the present without compromising the ability of future generations to meet their own needs"*[29]. It also popularized a three circles (or three-pillar) conceptual framework where overall sustainability demands sustainability in both economic, social and environmental dimensions. This framework was quickly adopted in more specific areas, including businesses (triple-bottom-line) and agriculture[30]. However, this definition and framework are not without problems.

One is that the needs of present and future generations are not defined. Some people therefore emphasize the 'development' part (the needs of present generations) and others the 'sustainable' part (the needs of future generations)[3,9]. Another related problem, much discussed in economics, is the way that future generations will be able to fulfill their needs. Those advocating views known as 'strong sustainability' argue that future generations should be endowed with at least as much resources as present ones, while proponents of 'weak sustainability' argue that it is enough if the same needs can be attained through human-generated 'reproduced capital'. There are also multiple points of view in ecology, where sustainability is framed in terms of the preservation of sufficient resources, or the processes by which those resources are regenerated[31].

Scale and time are also important considerations frequently overlooked. What appears to be sustainable at a certain scale may contribute to unsustainability at a larger scale, and vice-versa[30,32]. Likewise, practices sustained over centuries or millennia can be unsustainable over large time frames[33,34].

With so many complexities, it is understandable to think that the term may have become meaningless and prone to abuse by less scrupulous entities[35,36]. Nevertheless, many attempts have been made to measure and evaluate sustainability 'objectively'.

### Measuring Sustainability

One well-known indicator is the Ecological Footprint. It purports to measure the area of land (and water) necessary to support the flows of matter and energy to and from any defined economy. The authors acknowledge the limitations of the indicator (e.g., simplification, use of averages), but stress its analytical and educational contribution to decision-making over its accuracy[3].

The Sustainability Assessment of Food and Agriculture systems (SAFA) is a more assertive attempt at measuring sustainability through indicators and sub-indicators[37]. While purporting to apply to both small farmers, corporations and value chains, the type and amount of information required makes it more suitable for the latter two than for the former – the author of this thesis conducted a SAFA of a Swedish organic dairy farm and, if were it not for a liberal interpretation of the guidelines, most indicators would have a mediocre rate or remain unanswered, despite the farmers' best efforts.

Not all analyses of farm sustainability are as complex. Altieri & Nicholls proposed a simpler tool for a rapid farm appraisal that takes in account visible aspects of soil quality and crop health[38]. Another paper[39] presents a set of twenty questions to assess if agriculture is contributing to sustainable livelihoods, as well as a framework to develop local indicators for a viable and durable agricultural systems.

Though different, a common idea among these attempts is that a value can be assigned to a specific condition and tracked through time. Bell & Morse, however, question the idea of sustainability as an objective reality that can be accurately measured:

*"sustainability is the mindset of those who are intimately entwined with its achievement, and not an entity that lies 'outside' of our heads. In other words, sustainability cannot be studied as we can study an ecosystem. Like the term environment, but far more so, sustainability is what we want it to be and can change as we change. It is an organic and evolving construct of our minds and not an inorganic and static entity that can be physically probed."*[40]

Thompson even questions that sustainability always needs measuring, noting that:

*"… it is better to be lucky than smart. If we have simple norms that provide little insight into the regenerative systems of ecology and society but that guide our behavior in ways that allow those systems to function, we should retain those simple norms. We ought not replace them with complicated conceptual or mathematical models that are 'smart' in terms of providing predictive knowledge of system failure but are too complex for people to follow on a day-to-day basis."* [31]

These ideas do not render the concept of sustainability useless. It has helped to raise awareness and mobilize efforts around important problems and attempts to measure it also provide further insights on problems and possible solutions. What they highlight is the idea that developing sustainability indicators needs not only a careful reflection of the assumptions behind what is understood and hoped as sustainability, but also the processes through which societies move towards sustainability or away from it.

The following paragraphs review some of the alternative models proposed to achieve a 'sustainable agriculture'.

### Organic agriculture

There is a growing body of literature studying alternatives to conventional agriculture. The area most studied has probably been the comparison between conventional and organic agriculture. These studies usually cover a small number of variables over multiple farms (e.g., conventional corn/soybean vs. organic corn/soybean)[41–45] or in relatively controlled field trials[46], rather than diverse farms. They conclude that yields are generally higher in conventional agriculture (though not for all crops or in all circumstances), but profitability, energy efficiency and social and environmental outcomes are better for organic production[44,45,47,48]. Even so, some are growing concerns that some growers follow the letter of law but not the core principles and values of organic agriculture[49,50].

### Agroecology

Agroecology is concerned with a broader context[51] and multiple dimensions[52]. Research on diversified[53,54] and multifunctional[55–57] farms is receiving more attention though it appears that the economic aspects are not as studied as the ecological and social ones. Theoretical frameworks to measures the productivity of complex systems already exist[58] but actual values for specific farms are more difficult to find. Other topics receiving attention are the role of local systems[11,32] and the transition to more perennial solutions[10,59]. Much agroecological literature illustrates the potential of these approaches to increase yields and farmer incomes, particularly at smaller scales in poorer countries[36,60]. This potential is acknowledge in the Report of UN's Special Rapporteur on the right to food, which views agroecology as a key aspect for sustainable production, poverty reduction and local food systems support[61]. However, just as with organic farming and 'sustainable agriculture', there is an increasing concern that even agroecology may be co-opted by other interests[36].

This thesis views agroecology as the study of food systems from the perspective of ecology: looking at both biophysical and socioeconomic elements and their interactions, but knowing that are emergent properties that manifest themselves only when the system is viewed as a whole.

### Permaculture

Permaculture emerged in the 70s out of concerns with energy scarcity and ecological degradation and was influenced by the systems ecology perspective of HT Odum[62]. It emphasizes the conscious use of design to develop sustainable human settlements and *"agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems"*[63,64]. While it started with a focus on farm-scale developments, many permaculture projects developed an emphasis in education and were applied at a garden scale. In the US the number of educational permaculture sites far surpasses the number of farms using permaculture[64]

Principles and themes in Permaculture largely overlap and sometimes extend those found in Agroecology (e.g., importance of spatial configuration, system design and importance of water management). Like agroecology, it is a multidimensional concept that involves design approaches, practices, social movements and coherent worldview[62]. Permaculture has been criticized for broad and optimistic claims based on anecdotal evidence, downplaying challenges and risks and little reference to scientific information. Researchers, for their part, have not taken much interest in analyzing permaculture closely[62,64].

Nonetheless, permaculture offers promising avenues for agroecological research. It highlights the importance of design and spatial configuration in highly diverse systems, with increasing interest for farm-scale[19,62,65]. At its best, it provides a guide to beginners and experts in a way that emphasizes observation, experimentation and creativity. While agroecology is favored by scientific and institutional audiences, Permaculture appears to enjoy more interest with the general public, possibly due to a positive approach that emphasizes personal responsibility and action.[62]

### Regenerative farming

The concept of 'regenerative organic agriculture' was first articulated by Robert Rodale in 1983 to emphasize the need of going beyond simply sustaining to actually improve the resources it uses. It is described as "a holistic systems approach to agriculture that encourages continual on-farm innovation for environmental, social, economic and spiritual wellbeing."[66] It is therefore aligned with agroecology and the fundamental principles of organic farming and permaculture. It does not prescribe an all-or-nothing set of standards or actions, but a path that can be adopted also by conventional farmers[67]. Key features are the emphasis on perennials in lieu of annuals, taking *"advantage of the natural tendencies of ecosystems to regenerate when disturbed"* and the importance of soil health for fertility and climate change mitigation[66]. Some argue that the quest for perennial grains is bound to disappoint and that 'natural' prairies would be better managed through grazing.

The 'regenerative' concept is also used by a number of farmers that aim to improve landscape health, productivity and profitability by working with ecological succession and nature's ability to regenerate. These farmers draw on inspirations such as P.A. Yeomans (scale of permanence in landscape design and water management), André Voisin (intensive rotational grazing), Allan Savory (holistic management), E.F. Schumacher (use of intermediate technology) and agroforestry. These sources range from well accepted such as agroforestry to highly contentious, such as intensive rotational grazing and holistic management[68,69]. Analysis of whole combinations of these approaches, including profitability and social outcomes, are hard to find.

### Conclusions of literature review and implication for this thesis

The concepts of 'sustainability' and 'sustainable agriculture' are widely disseminated, but ambiguous and contentious. An analysis of farming approaches should therefore clarify in which sense these terms are applied. The pursuit of accurate sustainability measurements is probably an illusion; at most, one can measure unsustainability. Therefore, frequent vigilance and reflection are at least as useful as complex models which are time and resource consuming. Systems that cycle matter and energy at smaller spatial and temporal scales are not necessarily more sustainable in a wider sense, but they make unsustainable trends more apparent.

The literature on alternative models of agriculture shows a shared concern for closing nutrient cycles. They also show overlaps in other aspects: the importance of diversity, the avoidance of toxic products and the central role of a healthy soil. This is not unsurprising, as they share many sources of inspiration, at least until the 1980s.

Both organic farming and agroecology are recognized in academia and political circles. Organic agriculture has received more research, but often of a more reductionist type. Agroecology studies a wider range of issues and more diverse systems. Still, research usually covers a few variables over many farms and rarely the other way around. This may happen because complex farms are harder to study or due to a misconception that research must be amenable to statistical treatment to be scientific or generalizable[70,71]. Studies combining personal values, entrepreneurial details and ecological outcomes appear to be even rarer.

However, these dimensions may be well be critical for change. As noted by both Paul Thompson and Wendell Berry, achieving sustainability – or other outcomes for that matter – is not a matter of technique alone, but also of the motivations, skills and circumstances of those yielding the techniques[72]. Permaculture and regenerative agriculture place a greater emphasis on these topics, but the lack of independent research makes it difficult to assess the validity of their claims to larger audiences.

A closer inquire to how these approaches fare on the ground may help to clarify what contributions they make bring to current and aspiring farmers, to food systems research and to society as a whole.

# 2. RESEARCH QUESTIONS, METHODOLOGY AND SCOPE

## RESEARCH QUESTIONS

This thesis begins with the paradox that farmers writing about alternative farming approaches have received much attention from the general public, but little from researchers. The main research question asked is thus:

> *(Why) should agroecologists (and aspiring farmers) pay more attention to farmers/authors promoting highly diverse farming enterprises?*

The assumptions explored is that such attention is deserved because:

- Their approaches are actual implementations of good ways of farming;
- They have the potential to promote a broad adoption of good ways of farming;

These assumptions require some clarification about their meaning and the criteria by which they can be judged.

### What is 'a good way of farming'?

Much research (and public discourse as well) has condensed similar questions ("is X a good approach?") under the concept of sustainability, understood as the intersection of environmental, economic and/or social dimensions.

As seen in the introduction, that framework is often inadequate. Not clarifying what is to be sustained, by whom or for whom, one risks confusing means with ends. This may lead to misunderstanding, if not duplicity and thus to unfruitful discussions and confrontation. I think it is preferable to separate the idea of 'sustainability' of a system (or, in this study, of an approach to farming) in two sub-questions:

- *(Why) are they morally desirable – how do they contribute to a better society?*
- *(How) are they able to sustain their main characteristics over the long term?*

The first question requires clarification of what is "a better society". In short, I will seek to answer it from the perspective of those that place a high value in (a) leaving the next generations a planet that is less polluted and more ecologically diverse and (b) a food system that treats farmers, workers and animals with respect and dignity.

The second question requires understanding about what is meant by "main characteristics". Here I will consider not only the main outcomes (food production) but also the resource base (e.g., soil, water, knowledge, capital, etc) and functional relationships (e.g., interactions between soil-water, plant-animal, supplier-producer-client, etc.) that make those outcomes possible and resilient to adversity.

A given approach is 'good' if it is better than others at moving us towards these goals, even if only in its specific context.

### What is an approach with 'potential for broad adoption'?

To be studied as more than a curiosity, however, an approach also needs to have the potential to be adopted in a significant area or number of farms. This potential can be better investigated by clarifying two additional questions:

- *How broadly can it be adopted?*
- *Does it articulate a narrative that appeals and resonates with different people?*

One criticism of industrial agriculture is the blind adoption of uniform models without regard for the specific conditions of each place and person[73]. The first question does not refer to this idea of exact transposition of a blueprint. It rather asks if the main ideas can be adopted and adapted on farms and by farmers in different circumstances, or if there are obvious difficulties or limitations (e.g., resources, climate, market conditions) that will likely confine the approach to its original context.

The second question assumes that being 'good' is not necessarily enough for a practice to spread – this 'goodness' also has to be communicated in a convincing and appealing way. To assess that it is necessary to analyze the underlying values and the narratives that convey them.

## BOUNDARIES AND SCOPE OF THE STUDY

The following paragraphs explain the limits that were observed to maintain the study within a clear focus and manageable proportions.

### System under analysis and limits considered

The study centers in the approaches to farming of three farmers: how their goals and strategies find expression in the farm as a landscape and as an enterprise. The analysis of the approaches' desirability and sustainability takes in account their relations to family, customers and community insofar as the farmer has some influence. The discussion of the approaches' potential for broad adoption extends these boundaries to other places and societies and adds emphasis to the underlying values and narratives.

### Nature of the conclusions expected

Each of these sub-research questions can easily justify a thesis on their own. Unfortunately, I have not found research covering specific farms. So I set out to study what preliminary conclusions can be drawn. Following Yin's suggestion[70], this study takes an exploratory nature rather than a descriptive or explanatory one. This means that it does not try to provide a conclusive explanation to a problem or describe the farm or farmer in detail. Instead it presents the key characteristics and explores the philosophies, strategies and practices employed to see how they work and what relevance they have. The investigation of the potential for broad adoption is naturally more speculative and focus on possible obstacles to adoption instead of where or how it can be adopted and in how its narratives can help or hinder its adoption.

# RESEARCH METHODS

## Reasons to choose a case study analysis

This enquiry was mainly conducted as a case study following the approach described by Yin[70]. The case study was deemed an appropriate methodology because:

- The main research questions are in the form of "how" and "why";
- Investigates contemporary phenomena in depth and within its real-life context;
- There are more variables of interest than data points;
- There is no control over the phenomena studied.

## Cases selected

The specific cases selected are: Joel Salatin and Polyface Farm in Virginia, USA; Mark Shepard and New Forest Farm (NFF) in Wisconsin, USA; and Richard Perkins and Ridgedale Permaculture in Sweden. Joel and Mark were selected due to the popularity of their writings (Table 1) and the difference in their approaches (pasture based meat/egg production vs diversified agroforestry). Richard, who has just finished writing his own book, was selected for combining both approaches in a smaller area, to provide a European context and due to the chance of visiting the farm.

**Table 1 - Search results for different authors and book titles**

| Expression | Results |
|---|---|
| "Mark Shepard" | 150,000 |
| "Mark Shepard" AND "Restoration Agriculture" | 35,900 |
| "Joel Salatin" | 338,000 |
| "Joel Salatin" AND "You can farm" | 15,300 |

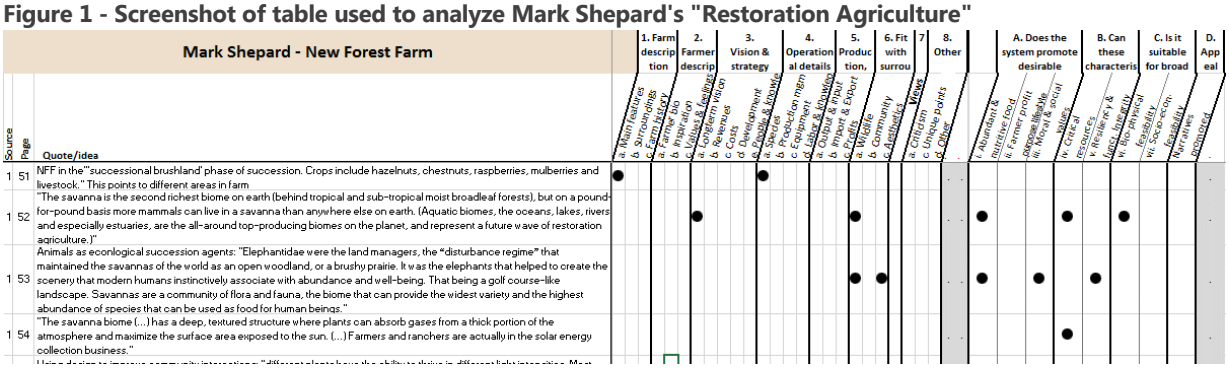
Source: Search results using google.com on 15/04/2015 between 16:00 and 16:30

## Methodology of analysis

The study of Polyface and NFF relies on books published by Joel[14–16,18] and Mark[19]. Pertinent ideas and quotes were extracted and classified according to the research questions (example in Figure 1) and supplemented with interviews and information available on their webpages and elsewhere. The study of Ridgedale is based on the impressions gathered over the 14 days of duration of a Permaculture Design Course (26/09/2015 to 09/10/2015), on two semi-structured interviews over skype and on Richard's comments to the analysis of his farm and approach.

Both Mark and Richard were also invited to review a draft of the manuscript that concerns their farms and provide feedback.

**Figure 1 - Screenshot of table used to analyze Mark Shepard's "Restoration Agriculture"**



## Ensuring rigor and validity

As with experiments, several measures have to be taken to ensure rigor and validity:

- The research questions were developed after a careful review of pertinent literature. In particular, much care was taken to explore the context and develop a theory that informs the research questions and the discussion of the results.
- The study involves multiple cases to observe similarities and contrasts;
- A case study protocol was developed to provide consistency and reliability;
- The research questions were organized in a hierarchical and coherent order;
- Multiple sources of evidence were used (books; writings; interviews by third parties; semi-structured interviews by the author; participant observation);
- The informants were presented with a draft to provide feedback corrections;

## Developing interview questions / data collection priorities

As proposed by Yin[70], the questions were hierarchically developed, from level 5 (normative questions, conclusions and policy recommendations) to level 1 (specific questions and data collection). This helps to maintain a logical thread between the main questions and sub-questions, and to distinguish data collection from analysis and interpretation. In this way, the study is more rigorous and replicable. Table 2 summarizes the questions and how they relate to the thesis' chapters.

**Table 2 - Hierarchy of research questions (main research questions underlined)**

| | | | |
|---|---|---|---|
| 5 | **(Why) should agroecologists (and aspiring farmers) pay more attention to successful pioneers promoting highly diverse farming enterprises?** | | Ch. 6 Conclusions |
| | What novelties do this study and these farmers bring? | | Ch. 5 Discussion |
| | What could be the consequences of broad adoption? What policies are needed? | | |
| | What are the criticisms and alternative interpretations to the findings of this study? | | |
| | What are the study's limitations? What specific topics deserve/require more research? | | |
| 4 | **(Why) would their adoption contribute to a more desirable society?** | | Ch. 4 Comparative analysis of cases |
| | **(How) are they able to sustain their main characteristics over the long term?** | | |
| | **How broadly can it be adopted?** | | |
| | **(How) does it appeal and resonate with different people?** | | |
| 3 | What are the common themes behind the proposed approaches (in values, farm design, production management and business strategy)? | | |
| 2 | Produces food in abundance and quality? | Creates resilience and functional integrity | |
| | Rewards farmer aspirations? | Would it succeed in different biophysical and socioeconomic contexts? | |
| | What moral and social values are advanced? | What narratives are conveyed? | |
| 1 | 1. Farmer's description (biography; sources of inspiration and information; worldview) | 5. Operational details (management of species, soil, water, nutrition, diseases, labor and equipment) | Ch. 3 Presentation of individual cases |
| | 2. General characteristics and context of the farm (features; surroundings; history) | 6. Production and Profitability (how much production, imports & exports, income) | |
| | 3. Long term goals and vision for the farm | 7. How does the farm fit in the surrounding landscape and community? | |
| | 4. Business strategy (strategies to increase revenues, lower costs, develop business and manage people and information) | 8. Other information is worth noticing | |

# 3.PRESENTATION OF INDIVIDUAL CASES

## JOEL SALATIN'S POLYFACE FARM

### Summary of the approach proposed

Joel proposes a way of farming that combines Jeffersonian agrarianism, with business savvy, environmentalism, libertarianism and Christian ethics.

His approach for productive and profitable farming, materialized in his 223ha farm in Virginia, USA, involve "putting grass on a pedestal"[16] and working with animals' nature while carefully assessing business and personal decisions. Joel advocates localism and seasonality in food production but is staunchly opposed to achieve these through central regulation. Instead, he pushes for a deeper involvement of customers and communities with their food and their farmers.

In addition to being an 'open-door' farm, every summer Polyface holds a Farm's Field Day where more than a thousand people (1,700 in 2011) come to learn about Joel's methods.[74]

### Data collected

#### 1. General characteristics and context of the farm

*1.a. Where is the farm located, and what are the climatic and biotic characteristics?*

Polyface Farm is Virginia's Shenandoah Valley 16 km from Staunton (25,000), Virgina. The biome is temperate broadleaf and mixed forests[75]. The climate is humid continental (Dfa/b)[76], with ~1000mm of well distributed rainfall and temperatures going below -20°C or above 30°C only in few days a year.

**Figure 2 – Polyface Farm location**

Source: Google Maps

*1.b. What are the main features of the farm*

Polyface comprises 550 acres (~223ha), of which 450 acres (~182ha) are forest and 100 acres (41ha) are pasture. Joel has dug ponds in the property to water animals and permanent fences are laid "along the topographic break points between ridge and slope, and slope and swale, in order to create biodiverse field, forestall and riparian edge"[77]. The main products are grass-fed beef, broilers, eggs, rabbits, pork, turkeys, vegetables and firewood. Joel now leases several farms in the area (at least 700 acres/283ha[78]) to meet an expanding demand.

*1.c. What is the farm's history and surrounding areas?*

When Joel's parents bought Polyface in 1961, the farm was in poor condition: "It was the most worn-out farm we looked at, but Dad and Mom thought it was the best buy (...) the land had been plowed for small grain for a century" and resembled "pictures in booklets describing the tragedy of American soil erosion. Many gullies measured 10 feet deep (...) Most of the land had no black topsoil. In places the red clay and shale came right to the surface".

Many of the neighbors are 5th or 6th generation farmers whose lands were also in poor condition, but not as much as Polyface, which was rented for years. Polyface is also surrounded by "several neighbors who produce high-quality food or crafts"[79].

## 2. Farmer's description

### *2.a. Farmer's biography*

Since his teenage years, Joel worked in the farm and ran his own pastured chicken operation, which he also processed and sold at the local farmers' market along with other farm products. Joel graduated with a bachelor's degree in English and worked 3 years as a reporter in a local newspaper, which had a profound influence: "that put me in touch with the agriculture community and with farmers. I heard horror story after horror story and realized that our farm had to be completely different from what I was seeing if we were going to make a living at it".[16]

In 1982 Joel resigned and went back to the farm full time with his wife[18]. The transition of farm business occurred smoothly over time: "From the day he [father] knew I wanted the farm, he eased control over to me."[16]

### *2.b. Where does the farmer find inspiration and information?*

Joel was directly inspired by his grandfather ("a master gardener and craftsman") and above all is father: "Dad was a genius (…) He developed a portable electric fence system in the early 1960s, understood soil development, composting, and nutrient density. He also understood debt and profitability, margins and value-added marketing"[18].

Major influences were the works of, André Voisin, J.I. Rodale and Sir Albert Howard. Joel also looks for inspiration in nature: "The truth manifests itself in natural principles of plant and animal life. The farm should capitalize on these laws rather than fight against them."[14]

### *2.c. What values are fundamental to the farmer? Where is he willing to compromise?*

Joel describes himself as a "Christian-libertarian-environmentalist-capitalist-lunatic-Farmer"[80].He believes that "God created the Earth and established humanity as its steward, to nurture, protect and embellish (…) This philosophy precludes the use of toxic chemicals, debasing substances and erosive practices"[14]

Joel believes people can "can improve on 'pristine' nature (…) as long as the changes are within the parameters of proper environmental considerations: clean air, clean water, healthy plants and animals."[16] He advocates a holistic approach: "The whole mentality of viewing ourselves as species-specific practitioners destroys the holistic mindset that sees the farm and, indeed, our whole lives, as being a non-compartmentalized whole"[16].

Besides ethics, Joel regards financial incentives as crucial for good management: "The surest way to destroy property is to eliminate responsibility for its care and to eliminate the profit motive from sound stewardship. Certainly, pure capitalism, without morality, is not much better (…). But capitalism with morality is positive".

Joel believes that the way society treats animals reflects the way it will treat people[81] and therefore "animals should be giving a chance to express their animal-ness."[16]. This does not mean going to "heroic efforts to save an animal like we would a human. (…) occasional losses will occur [and] a bleeding hear farmer will soon be a bankrupt farmer."[16]

Joel also values thrift and discipline: "we patiently plodded toward a dream, and disciplined our short-term gratification in order to enjoy long-term success."[16]

He is a staunch defender of localism and does not ship his products farther than what a person can drive in a day (~4 hours away).

## 3. Business strategy

### *3.a. What are the long-term goals and vision for the established farm?*

Joel's stated mission is "to develop emotionally, economically and environmentally enhancing agricultural enterprises, and facilitate their duplication throughout the world."[16]

A primary goal is to continuously improve the farm: "We're in the business of producing soil and diversifying the landscape. That means we want to see the soil more fertile every year. It should hold more water produce better plants and require fewer inputs. We want to see more wildlife, more plants, and produce a wider variety of animals. We want more intersections of water, land and forest". Personal fulfillment is another major goal of his work: "our farm must allow for emotional enjoyment. (...) we must have slack times if we have busy times."[16]

### *3.b. What strategies are employed to increase revenues?*

Joel's strategies for success are based on doing things he enjoys knows well, adding value and selling at retail price while keeping costs low through simple solutions and multipurpose tools.

Polyface combines revenue streams from centerpiece (main) and complementary enterprises that have synergistic characteristics.

He claims that there is a growing market for clean and ethical products, as "now, everyone has heard of [sustainable and organic agriculture] and the niche is getting wider with each outbreak of food borne illness from the mega processing-facilities". In addition, "People are looking for designer anything, for uniqueness, for relationships"[14]. Polyface sells to local customers, e-mail-based 'metropolitan buying clubs' (drop points where meat is delivered eight times a year), local restaurants and retail outlets and even local fast food chains (Chipotle).

Taste, nutritional quality and cleanliness are the biggest selling points, and Joel often performs demonstrations to convince his audiences and customers. He prefers starting with low prices and explain raises[16]. He avoids lowering prices when there is over production, preferring to give away products as marketing incentives[16]. Over the time Joel had to adapt the way he markets, such as selling bagged products or cut-ups, as consumer demand has changed and "customers will only tolerate so much weirdness. You can be a nudist, and you can be a Buddhist, but a nudist Buddhist—that's just too weird"[18]. Polyface doesn't advertise, and relies instead on word of mouth, rewarding customers that bring new customers.[82]

Joel views processing as a critical to success, as "most people aren't going to buy unprocessed. If we're going to get affordable market penetration, especially in urban areas, we need to free up cottage industry"[18]. Together with a partner, the Salatins own a small community-based abattoir, without which they would have to travel twice as to have the animals processed. Polyface is currently the largest client but they also process meat for others.[18]

However, Joel warns that the drive to please customers can go too far and that a profitability analysis is necessary: "As entrepreneurs we are tempted to chase every potential customer (...) Often this enslaves us to low return items while high return items go begging". Similarly, he argues that "Knowing when to stop in your value adding is as important as knowing when to start. Not every amenity people are willing to pay for will be worth your effort."[16]

Joel also sees land improvement as a potential income strategy: "buy poor land rather than real good land. You can capitalize on the mistakes of others and turn poor land around."[16]

### *3.c. What strategies are employed to keep costs low?*

Joel favors low cost approaches and is constantly trying to do things more easily and efficiently

Joel favors form over function as trying to 'keep up with appearances' “spells doom for many farmers”. He argues that, in truth, “really profitable farms have a threadbare look”. He is particularly critical of expensive barns, (“portable facilities and simple hoop houses for winter housing work wonderfully well”), and advocates multi-purpose machinery (“Incorporate multi-purpose into every thought”) and a rigorous cost-benefit analysis of every equipment: “A lot of foolish things have been purchased in the name of farming, just like many a fool has done evil in the name of religion”[16]. When he has to buy machinery, Joel often buys second hand and looks for dependability over cheapness”.[16]

Following seasonal patterns is crucial to keep costs low: “off-season vegetable and fruit production may compensate for this extra cost but meat, poultry, dairy and eggs do not."[16]

Other strategies to reduce costs include making own fencing posts with farm lumber, use veterinary services only when it pays (mostly for diagnostics) and settling for ‘good enough’ (trying to get to perfect fertility quickly is expensive in time and money) and saving in living expenses: “The best money you can make is what you save on living expenses. (…) you can live quite cheaply. As the farm becomes lucrative, you can begin to upgrade.”[16].

### *3.d. What was the approach to establish and develop the enterprise?*

Polyface has been developed since Joel’s parents bought the farm. They "planted many acres of trees until the original 160 open acres shrunk to only about 95”[16]. His father “developed a portable electric fencing system [and] began rotating the cows (…) every two weeks”[83]. This initial efforts of his parents allowed Joel to return to farm full time and grow the enterprise.

Joel counsels others to start small and grow slowly and steadily: “acquiring land before experience or customers is often getting the cart before the proverbial horse”. Besides, “going slower keeps our cash requirements lower and allows our experience and stewardship level to come up on par with fertility, in a balanced approach."[16].

His criteria for a good centerpiece enterprise are: low initial start-up costs relative to income generating ability; high profit margin; low maintenance; high cash-flow vs. expenses; product distinctiveness; and size neutral profit potential. Pastured broilers, eggs, beef and dairy, market garden, home bakery, u-pick small fruits are examples that fit these criteria.[16]

Criteria for good complementary enterprises criteria are: using existing infrastructure; use low working times; distribute cash-flow; recruit new customers; and increase current customer purchases”. Examples of such enterprises are: Pastured turkeys; lamb; stockers; pork; rabbits, firewood; recreation; flowers; honey; and cottage industries”. These enterprises can also be managed by the farmer’s children and become one day their centerpiece enterprise. [16]

Joel has met an expanding market demand by leasing farms from neighbors (often run by former Polyface interns or apprentices) which still maintains “a decentralized, spread-out production and processing model[18]. In the future, Joel’s “long range plan is to break off our enterprises as self-maintaining profit centers for the next generation while we receive royalties. The next generation gets the benefit of our experience and capital while we get the benefit of their energy and curiosity."[16]

### *3.e. What strategies are in place to manage knowledge and people needs?*

Though Joel states that "a farming enterprise succeeds or fails primarily on its philosophical underpinnings, not on hard-core how-to information"[16], he places much value in information, not only of the financial type, but also what he calls 'marketing type accounting' (information on customers and sales) and 'production accounting'[16]. As he states:

"I am a huge believer in time and motion studies. Start by timing all of your tasks and see what you can do to make them more efficient. Ask yourself why you do things the way you do. Create a map of your farm, trace your steps one day, and ask yourself if you're going places redundantly. Write a list of tasks that can be done in an hour or less, and carry that list around with you; when you have a spare hour, maybe at 4:00 when it's not time for supper yet, do one of those tasks"[84]. Though Joel is always looking to improve efficiency, he cautions that cutting corners is often the quickest way to failure.[14]

Joel recognizes the limits his knowledge ("The more we know about nature, the more we know we don't know."[18]), and keeps an open mind regarding learning opportunities: "I am familiar with many things: biodynamics, holistic management, permaculture, (...) conventional organics, conventional feed and forestry practitioners. I haven't met a person yet from whom I couldn't learn something. One of the biggest pitfalls in a 'movement' is the temptation to get cultish about it and refuse to realize that it is only part of the picture."[16]. However, Joel advises against sellers and advisers that have their own agendas as it often leads to bad decisions"[16].

In 2011, Joel had 14 employees and also apprentices, to which they "provide room and board plus a stipend based on farm cash flow and individual initiative". They aim for one-year commitment, although we sign no agreements are signed, which "builds mutual respect and offers boundaries for behavior and interchange".

Joel remarks that "if you devote yourself to people, holding them in high esteem, farm labor can be a fairly easy problem to solve". Doing something new and different helps to attract help, but that "to attract good apprentices one must have an ongoing, viable farming enterprise." They are very discriminatory in their acceptance standards as "some folks can be helpful and others would be most helpful by staying away". For many years, Polyface did not take female interns, because they knew cases of farmers that had taken female interns and gotten "crossways somehow", and they prefer to avoid that problem[16,18].

Besides employees and apprentices Joel also trades work with friends and neighbors. Another significant source of labor has been his fellowship group. Their home-church and "encourage community interaction by holding workdays at each other's homes"[16].

## 4. Operational details

### *4.a. What are the main species present? What was the reason for their choice?*

Polyface pastures and forests have several types of grass and trees, but a comprehensive list is provided. The main animals are broiler chickens, layer hens, cows, pigs, rabbits and turkeys.

Polyface has Cornish cross broilers for marketing reasons, as heritage breeds were not well received – customers are used to the large breasts and white meat of the Cornish cross. Plus, they grow faster, are easier to process and chicks are widely and consistently available. They try

to fight the downsides of the Cornish cross (not hardy or good foragers, needing supplements due to fast growth) with good management and nutrition.

For the other animals, no information was collected on the breeds. The reason for their choice and use is explored in the point below.

### *4.b. How are soil, water and nutrition managed?*

#### *Grass*

Grass is a focal point of the enterprise's management: "Grass-based approaches are necessary due to the nutrition, vitamins and natural antibiotics, to provide exercise to animals, fresh air and sunshine, soil building, food quality and economics"[16]. Pasture quality is developed through short duration, high density grazing. Salatin explains that "lightweight, highly portable electric fence allows us to define each day's grazing block, called a paddock, and concentrate the herd onto that spot like bison corralled by wolves". By denying the herbivores access to a paddock until the grass has rested enough to go through that middle rapid growth period of the S curve, we metabolize far more sunlight into biomass than would otherwise occur".[18]

#### *Animal management*

Grass management is closely related to a careful management of animal interactions: "We can't have more eggs than we have cows to mow ahead of the Eggmobiles. (…) Everything needs to come up together to leverage the gifts and talents of each. This intricate symbiosis only works if it stays in balance."[16]

Cattle harvest as much of their own feed as possible: "the past winter we fed hay for only 68 days; most farmers in our area fed hay for 140 days. It's typical for farmers to brag about how much hay they make; I like to brag about how much hay we did not make"[16].

The cows are followed by 'egg-mobiles', which house free-range hens. These "scratch through the cow pats, eat the fly larvae, and scavenge newly exposed grasshoppers and crickets from the shortened sward". This improves nutrient cycling, sanitation and cuts hen feed by 20%[16]. Later in the year the fields.  Pastured broilers are moved into the paddock at a different time of year, and turkeys can follow after that.

Chickens are also used in the rabbit house where they "not only build compost out of the rabbit droppings, but also keep the rabbits healthy"[16]. Rabbits are also raised on pastures, which cut their intake of purchased feed by 60%, while building soil ("we are having to replace the wire every 5 years because the soil builds up over it"[16]).

Chicken spend the winter in hoophouses, where they eat insects between vegetable crops. The roosts let their manure drop to earthworms which feed on the manure and are later fed to the chickens"[16]. In the winter, cows are fed hay in a simple shed with deep bedding which protects their manure from leaching rains. Grain is added to this 'manure pack' and when cows return to pastures in spring, the pigs moved in. "They seek out the fermented grain kernels, digging and mixing the bedding, tearing all apart and creating the finest compost imaginable"[16]. This process produces more than 200 cubic yards of compost per year[16] and, as Joel remarks "has been the heart and soul of [their] fertility program for decades."[18]. Pigs are also used to till, turn and aerate chicken bedding and to maintain forests clear of bushes"[16].

### *Soil*

Joel is skeptical of relying too much on soil analysis and expert recommendation: “Regardless of these scientific measurements and designations, fertility principles span all climates and soil types. In fact, don't let scientists limit you too much, you can totally change the productivity of poor soil to nearly that of your favorite fertile spot - given enough time, the right materials and an indomitable spirit.”[16]

His experience of fifty years has shown him that by using “perennials and animals, lots of compost, and patience, the soil has rebounded and [rocky areas with little or now topsoil] are covered with several inches of fertile soil”[18]. This contrasts with the areas where cattle was fenced out. These “are still barren and soilless just like they were in 1961”[18].

### *Water*

Joel states that: "As I look at the landscape of our farm, I am always thinking about water. How to slow it down. How to hold on to it. How to get more use out of it. How to hold on to it so it doesn’t create a flood problem to neighbors downstream”[18].

He views organic matter in the soil as the best way to store water, but also uses cisterns, ponds and favors landscaping for better water management such as "digging swales just off contour to duct surface water either into a pond or just to keep it from running down the side of the hill"[16]

#### *4.c. How are losses to pests, diseases, weeds and predation managed?*

Joel avoids health problems by avoiding the conditions that favor pathogens.

Light, dryness and proper decomposition are central elements in his strategy. Though these can be accomplished by having the animals outdoors whenever possible, Joel cautions that “the outdoors is not inherently hygienic, any more than being indoors is necessarily unsanitary. Both require careful management”. Dryness and decomposition are also achieved with deep bedding, which "requires handling carbonaceous material, [but] pays for itself in feed savings, animal comfort and performance, and especially in animal health.”[16]

Having different animal species in the rotation also helps to break host-pathogen interactions. However, it is important “to maintain the natural chain of who follows whom. For example, in the hay shed the pigs follow the cattle (...) If chickens and cows are together, chickens manuring in cow feeders can be a real sanitation problem.”[16]

Joel tries to have “healthy forestal and riparian areas growing small mammals and birds” so that predators are well fed and don’t target the chicken”.[16] The occasional predator that insists on attacking birds, however, is hunted with traps or guns.

#### *4.d. What type and how much energy is use and generated at the farm?*

Joel views the farm as a “giant reservoir, collecting solar energy”[16]. Although no numbers are present, Polyface consumes and sells firewood, which Joel manages as a renewable resource.

Joel argues that his system is not only more energy efficient than grain-based confinement systems (“we performed a cost analysis of gross sales compared to energy used and we were different by a factor of 10.”), but also more robust (“on our farm, if the electricity goes off, the pastured poultry just go right along about their business.”[18]

#### *4.e. What is the main equipment/infrastructure used?*

Joel has "two tractors, and both of them are four-wheel drives with front-end loaders" and several trailers[16]. Other critical equipment is portable electric fencing, which allows to "efficiently handle their livestock like nature did with large herds, migratory patterns, and predators"[18], the 'eggmobiles' and the broiler pens. Polyface also has two 120-foot x 20-foot hoophouses and a 'raken' house the for the rabbit litters[16]. This list is not exhaustive, and even these items may have change since the books' publication. Joel advocates that each farm needs basic workshop tools to build or modify equipment according to needs.

Joel keeps an eye for second-hand equipment, but does his due diligence on its condition.

He also advocates for a low-cost living in the beginning: "One of the quickest, cheapest ways to get under roof is a used mobile home. (…) I'm talking initially, to get going and put all your capital into the business. (…) First you put your fields in order, then you build the home. (…) Just as Teresa and I lived in the attic for our first seven years, you may need to live in less than accommodating circumstances initially too."[16]

#### *4.f. Other production details*

Currently, with Joel out of the farm many days a year in speaking engagements. It is his son "Daniel that handles day-to-day farm operations and tells me what I need to do. I wouldn't want it any other way."[18]

### 5. Production and Profitability

#### *5.a. How much does the farm produce? What inputs go into that production?*

Polyface produces on average 400 cow-days of grass per acre, while county average is 80[81]: "we are getting five times the county average production per acre. That is without planting a seed or buying a bag of chemical fertilizer in 50 years"[80]

Production at Polyface has increased over the years as several farms have been leased, some of which run by former Polyface interns and apprentices. This makes it difficult to have a clear understanding of the farm's production and productivity, but some partial figures are available:

- In 2005, Polyface's 'metropolitan buying clubs" were serving 200 families. In 2007, this number had grown to 900 families, in addition to 400 local families, which led Polyface to lease an additional 700 acres of pasture.[78]
- In 2009, Polyface had over 100 cows and served "over 1,500 families, 10 retail outlets, and 30 restaurants"[83].
- An article in 2010 claims that Salatin then fed between 7,000 and 9,000 locals[81], but this likely refers to number of customers, not full diets.
- In 2011, Polyface had 900 head of cattle and ~700 pigs, though it is not clear if or how many of these were managed by former apprentices or interns.[85]

Joel claims that not only his system is more productive, the production is of higher quality:

- A fat profile run at the Virginia Tech Human Nutrition lab found that Polyface birds averaged 0.54% fat (23.3% of which polyunsaturated) while Tyson factory birds averaged 2% fat (19.5% of which polyunsaturated).[18]

- A bacteria test reported an average of 3,600 CFU (colony-forming units)/mL on factory birds and only 133 CFU/mL in Polyface's pastured birds.[18]
- Grass-fed beef had more 300 percent in B vitamins and huge differences in conjugated linoleic acid compared to grain-finished.[18]
- A study paid by *Mother Earth News* pitting twelve pastured egg producers against USDA's standard nutritional egg profile also found significant differences in both good and bad substances (Table 3).[18]

**Table 3 - Nutritional comparison of Polyface eggs and USDA standards**

| Substance | USDA | Polyface | Diff. |
|---|---|---|---|
| Vitamin E | 0.97 mg | 7.37 mg | 660% |
| Vitamin A | 487 IU | 763 IU | 57% |
| Beta-carotene | 10.0 mcg | 76.2 mcg | 662% |
| Folate | 47 mcg | 10,200 mcg | 21602% |
| Omega-3s | 0.033 g | 0.710 g | 2052% |
| Cholesterol | 423 mg | 292 mg | -31% |
| Saturated Fat | 3.10 g | 2.31 g | -25% |

### *5.b. What are the main imports and exports of nutrients to/from the farm?*

No detailed account is given for the nutrient or energy balance of the farm. Polyface is grows a high proportion of its consumption and grows its hay and generates the compost that is applied in the fields.

The major input for the farm is the local GMO-free grain and rations fed to omnivores (poultry and pigs). Joel acknowledges that "this is a positive nutrient flow into the farm, just like buying fertilizer", but one that generates income. A "highly mineralized amendment" is also used in the compost.[16]

Joel realizes that "in the purest sense of the word, this may not be the most sustainable system, but let's not go bankrupt trying to be sustainable. Besides, (…) mutual dependency is a way to build community."[16]

### *5.c. What is the profitability and cash flow of the enterprise like?*

As with the production, there are little details on Polyface's financials. Furthermore, it is hard to understand the true value generated at Polyface as there is much production for self-consumption, not only in food but also in materials such as timber.

Joel recounts that the first years were lean and it took four years until they understood they could make it[82]. Likewise, the abattoir took "two years of get-acquainted financial hemorrhaging." Before it became profitable.

Revenues were about $1,000,000 in 2006, 1,500,000$ in 2009[86], $2,000,000 in 2011[85]. The biggest expenses are GMO-free grain bought from local farmers, salaries and medical insurance. The net income in 2009 was over, $150,000, about 10% net margin in 2009[86].

Today, Joel "spends a hundred days a year lecturing at colleges and to environmental groups"[80] and "commands several thousand dollars a pop for public speaking engagements"[81]. The profits from the weekend-farmer seminars as well as sales from instructional books he's written "are allowing us to make the investment without having to resort to loans"[78]

In 2011, Polyface was valued at $1.5 million, while the farm was bought in 1961 for $49,000 ($370,000 in 2011 adjusted by CPI*).[18]

* This, however, may be a poor measure. A farmland price index would be more helpful, but none was found for the necessary period (1951-2011)

## 6. How does the farm fit in the community and surroundings?

### *6.a. How does the farm fit with the surrounding landscape and wildlife?*

Joel values landscape diversity and wildlife: “diversifying the landscape brings in stability and balance. (…) The more edge effect we can create, the more varied species proliferate”[16]. The forest is managed to increase diversity: "even within cuts (…) I often leave den trees and snags. Den trees encourage squirrels and other mammals that need a tree home. Snags serve as roost for buzzard, crows and wild turkeys."[16]

Joel strives for an pleasant landscape “Our models must allow us to incorporate the whole family (…) children can go with us on every job."[16]. This is also noted by others that praise its “remarkable cleanliness. There are relatively few flies or mosquitoes—a surprise, considering the hundreds of grazing and pecking animals. Nor are there any obnoxious odors.”[85]

Joel strives to foster a supportive community not only by doing business locally and offering support to his neighbors, but also by watching his behavior, leading by example instead of lecturing: “Draw your neighbors to your lifestyle by reaching out to them. (…) Don't give advice. (…) Watch your appearance. (…) Offer assistance. (…) Do business in the community." [16]

### *6.b. What do you clients and neighbors say about the farm and the farmer?*

Joel claims satisfaction from his clients “we have many environmental sensitive customers and so far we have never had one react to our chicken.” And support from the community "We have 400 farm customers who would gladly help us out if we had a problem.”[16]

### *6.c. What do critics say about the farmer's approach? What is his answer?*

Salatin is not without critics. While bigger players argue that his model of agriculture is not based on science and ‘cannot feed the world’, others criticize using ‘industrial’ broiler breeds, not growing his own feed[87] and that “nostalgic images of Salatin as a White, male, yeoman farmer and the masculinization of sustainability [obscure] the tensions between Salatin’s free-market, anti-regulation politics and the mainstream environmental movement [an] support consumption and market-driven solutions to current environmental and food justice crises”[88].

When faced with the first criticism (productivity) Salatin’s, Joel argues that “this is the only system that really can feed the world."[81]. He gives four main reasons to support his argument:

- The world currently produces 50% more food than needed. People go hungry because they lack access due to poverty, logistics, war and politics[80];
- There is are vast areas of unutilized or underutilized land – 35 million acres of lawn and 36 million acres used for recreational horses[80];
- Monocultures are inefficient compared to well-designed polycultures and most livestock farmers still practice ‘Neanderthal management’, and do not use electric fencing, ponds, piped water, and modern scientific aerobic composting.[80]
- The apparent productivity of industrial systems hides a much larger resource base: “When industry representatives effuse to me, ‘Look how much one farmer can produce,’ I like to add, ‘Yes, the farmer plus a host of technicians, mechanics, field reps, drug companies, construction crews, pollution abatement workers, and logistics managers.’” [18] Joel also adds that science is not completely objective as “basic biases affect how we set up experiments, how we see the data, and how we interpret the results.”[18]

Regarding the second type of criticism (using industrial breeds and purchasing grain), Joel states he is not opposed to heritage breeds, and acknowledges that broilers are the least sustainable part of the operation. However, he has tried heritage broilers and there was not much demand from consumers, so he focuses on what he can improve[81]. He also does "not assume that all nutrient movement is anti-environmental". At Polyface, grain is not moving very far as it is coming from local farmers.

The last criticism is not addressed by Joel, perhaps because it was never put directly to him. However, by no means Joel obscures that he is at odds with parts of the environmentalism movement ("By no means am I a tree-hugging, animal-worshipping environmentalist; (...) To say that a farm is a factory is just as wrong as mysticizing a farm to the point that we say it is not even a business."[16]), and that his libertarian philosophy has downsides as well ("Yes, there will be dirty players. There always have been and always will be."[18]). Even though he often rails against the system, his goal is not to 'save the world', but to improve the current state while making a living: "I admit that I don't have the answer to all the fringes. (...) instead of picking away at the edges and challenging with the most fringe possibility, why don't we focus on the great majority for whom the idea is doable? "Most of us spend a lot of time and money dealing and worrying about things we can't do anything about anyway. If we would devote the same energy to our little realm of influence, the cumulative effect would be a much better society"[16]

### 7. What are the farmer's views on agriculture, food and society?

Joel is very critical of the industrial food system, although he is lenient to the earlier adopters: "I have a hard time faulting those 1920–1940 farmers for reaching for that bag of NPK. But I have little sympathy for those after 1950, less for those after 1960, and none whatsoever for anyone after 1970 who continued down that path. By 1970, everything was in place to leverage biological integrity. Anyone who refused to jump from the chemical soil ship by that time deserved to go bankrupt, lose their farm, or whatever"[18].

He is more critical of the USDA and government intervention that creates "a regulatory climate that protects the huge opaque anti-human-scale businesses and bullies entrepreneurial innovators" while its "track record on deciding what to promote as safe food is abysmal" [18]. He faults some activists with part of the blame as "rather than stimulating smaller facilities, backyard operations and neighborhood canneries and processing facilities, consumer advocates demand salvation by regulations which destroy additional small operators."[16]

Joel is nonetheless receptive to the idea that opaque production systems deserve more overseeing: "I have made it a point not to debate people who think we at least need governmental oversight for the processing entities hidden from direct customer interaction. If you have a guard gate, security fence, and no trespassing signs around the facility, perhaps government inspection is appropriate."[18]

Joel laments most people's lack of touch with the realities of food production: "To have a discussion about normal living, normal ecology, all my readers need to understand how ignorant we've become as a culture". He is particularly critical of the anthropomorphisation of the farm of 'anti-animal' environmentalists who "assume that all beef is feedlot beef and creates numbers from that model (...) As a result, we have environmentalists spouting the ignorant notion that cows are belching methane and causing global warming"[18]. In contrast, he claims that "if every farm and ranch that has cows in the United States would practice this

biomimicry, in fewer than ten years we would sequester all the atmospheric carbon generated since the beginning of the industrial age", an argument he borrows from Holistic Management International and Carbon Farmers of America.

He advocates, however, for responsible energy use, local food systems and transparency: An "extremely legitimate use for petroleum besides running wood chippers and front-end loaders to handle compost, it's making plastic for season extension [because] it parks many of the trucks. That reduces road-building and repair costs and exhaust. It reduces all the energy needed to smelt the steel to build the engines and chassis. It reduces packaging. It increases transparency because the food is grown closer to the point of consumption (…). The farther food production moves away, the less we can really know what's out there". "Integrity occurs when people can see what's going in at the front door and what's coming out the back door."[18]

Joel deplores the current standing of farmers ("Jefferson's intellectual agrarian dream [has] been replaced by a redneck hillbilly D-student") and argues that farming needs talent ("do we really want society's bottom feeders to be in charge of our air, soil, and water?"). However, society "will only have the best and brightest farmers when eaters realize that excellent farmers deserve white-collar salaries, and (…) demand their abilities in the marketplace".

Joel's views are sometimes at odds with his otherwise political fellows: "while I lean libertarian, the trade-off is that I am extremely big on personal responsibility. If someone sent pollution down my stream, I would fight to make sure that person cleans it up". He finds it "amazing that the conservative/liberal mantra, when it comes to resource stewardship, has flip-flopped" and finds more agreement with the opposite side of the political spectrum: ". But our family found a wonderful camaraderie with these left-leaning folks [hippies], a reverent view toward resources that we did not find among our friends in the religious right."[18]

Joel argues that developing a fulfilling career in farming is – and should be – demanding: "People who farm must be committed enough to sacrifice for it. Young people who want to farm could even devote their time and energy to a farmer they know, working for free if necessary to show their character and commitment, to merit being entrusted with a farm."[14]

Despite these difficulties he claims that his way of farming can bring a fulfilling change: "We as entrepreneurial farmers can take the reins of our own destiny and begin a steady, systematic journey toward opting out. We just refuse to participate in their [big agribusiness] game. We can either spend our energy complaining about things or making creative changes, Too many of us have tried the first path. I suggest we try the second one. You may not change your neighbor. You may not change the feed store. But you can change you."[16]

More important than eventual setbacks ("If it's worth doing, it's worth doing poorly first." Who ever does anything right the first time?"), is to have the right goals: "I don't care how much money you make, if it's not healing, it's not sacred enough to take your whole life's energy."[16]

### 8. What other information is worth noticing?

Joel reveals a deep emotional attachment to his farm: "Last fall I went to a (…) one-month speaking tour. (…) As Teresa and I drove out the lane that morning to go to the airport, I broke down, sobbing uncontrollably (…) It wasn't just this farm, the land—it was everything. (…) As the rest of the culture runs helter-skelter, always seeking something outside, demanding care from others, I have found contentment and satisfaction in this place."

# MARK SHEPARD'S NEW FOREST FARM (RESTORATION AGRICULTURE, 2013)

## Summary of the approach proposed

Mark Shepard presents 'Restoration Agriculture' as the "intentional design of productive agricultural systems that are patterned after natural ecosystems". It aims at a highly diverse system of beneficial synergies where the farmer manages a community of crops through its ecological successional trajectory. It is, as described by the author, an "agroforestry system on steroids".

## Data collected

### 1. General characteristics and context of the farm

*1.a. Where is the farm located, and what are the climatic and biotic characteristics?*

New Forest Farm (NFF) is located in Wisconsin, USA, 120 Km northwest of Madison (245,000). The climate is humid continental and lowest temperatures can go below -40ºC in some places. The soils are unglaciated and derived primarily from dolomite limestone. The soil is also poor in phosphorus and the export of calcium in crops and the addition of limestone has created an imbalance towards magnesium.

**Figure 3 - New Forest Farm location**

Source: Google Maps

NFF sits between the 'temperate broadleaf and mixed forest' and 'temperate grasslands, savannas and shrublands' biomes[75].

*1.b. What are the main features of the farm*

NFF comprises ~43ha of woody perennial polycultures, with different plant assemblies and different phases of ecological succession.

The larger area is a ~16ha savanna of "white oak (…) chestnuts, apples and a main crop of hazelnuts"[19]. A repeated pattern of "four rows of hazels, then one row of chestnut, apple, serviceberry, mulberry, black alder and raspberry"[19] occupies ~4ha. The remaining area includes denser chestnut plantations in ridges, alley crops of asparagus, squash, sunflowers, peppers and other plant assemblies, including a "multi-storied system of grapes trellised on walnut, with raspberries and plums planted within the row of walnuts"[19].

The system also includes pasture in the savanna and alleys which is grazed by several animals – cows, pigs, sheep, turkey, geese.

The trees, buildings and pastures are laid according to the topography, "with keyline swales designed to accept the excess water during large rain events water is captured and moved to the pocket ponds and overall toward the ridges. (…) some ponds may indeed be intentionally designed to do so throughout the driest months of summer."[19]

**Figure 4 - Photo of New Forest Farm and surroundings**

Source: Mark Shepard: Restoration Agriculture (2013)

### *1.c. What is the farm's history and surrounding areas?*

The farm was purchased in 1995. The previous owner stocked cattle but provided over 100 animals with little more than 1ha of young tree cover. In hot days the animals would seek refuge in this area which soon also became degraded. Prior to that, corn was grown.

The farm is surrounded by large conventional corn and soybean producers. The view during harvest time is desolating: "As far as the eye could see the landscape was the same — parched, compacted soil, lifeless as pavement with row upon endless row of corn stubble. To the horizon in the west, to the north, and to the east, nothing could be seen but barren, dusty, corn stubble. Aside from the combines, the scene was as lifeless as the moon."[19]

## 2. Farmer's description

### *2.a. Farmer's biography*

Mark grew up on a hobby farm (4ha) in central Massachusetts in the 70s. His mother was displaced farm girl and father displaced woodsman who taught their children gardening, cooking and nature skills. The "childhood experiences in the woods gathering firewood and working in the garden took on a grand seriousness that would prove to be foundational to [his] thinking, [his] career choices and in fact, [his] entire life."[19] He helped his father who, during the oil crises tried to derive as much nutrition possible from the farm, and worked picking apples for an old grower who "told me about growing fruit in 'the old days'"[19].

Although "professionally [he is] neither a mechanical engineer nor ecologist, [his] college education is in both fields" and he has 20 years of experience in farming. He was certified as a permaculture designer in 1993 and teaches agroforestry and Permaculture worldwide. Mark is also "is the founder and chief Cydermaker for the Shepard's Hard Cyder winery in Viola, Wisconsin."[89]

### *2.b. Where does the farmer find inspiration and information?*

Mark's initial inspiration came from the differences he saw of working in the garden and in the woods: "Why was it that growing our garden produce (vegetables and small fruits) was so much work, and yet out here in the woods and in the border between the woods and our garden there was so much to eat, and we did nothing but harvest the bounty? There was no work involved"[19].

Learning that even Henry David Thoreau depended on annuals and celebrated homesteaders such as Scott and Helen Nearing did not provide their own staple crops pointed Mark to the need for perennial systems that can provide staple crops in abundance. The main inspirations for Mark's work in perennial woody crops came from:

- J. Russel Smith's "Tree Crops: A Permanent Agriculture";
- "The One-Straw Revolution" by M. Fukuoka
- Permaculture, as presented by B. Mollison and D. Holmgren.

He states that Permaculture, in particular "helped me to unify two parts of my educational past (ecology and engineering) and to bridge gaps between seemingly opposite environments such as the garden and the forest."[19]

### *2.c. What values are fundamental to the farmer? Where is he willing to compromise?*

This issues are not discussed directly. Mark clearly views monocultures and regular use of herbicides or pesticides as damaging. He is not fond even of organic-approved insecticides as

he laments that “so much of what we are taught in agriculture is how to kill stuff that wants to live and how do we keep this stuff alive that wants to die”[19]. He prefers to suffer initial losses but eventually achieve superior genetics and a dynamic equilibrium between pests and predators which will save work down the line.

On the other hand, he accepts the possibility of growing a small crop of grains and legumes to supplement chicken feed and also grows some annual vegetables himself. He does not preach a ‘unique way’, and views different agroforestry approaches as different ways for farmers to move towards something similar to what he proposes. Mark places much value in his time and doesn’t see the point of doing much effort for small benefits

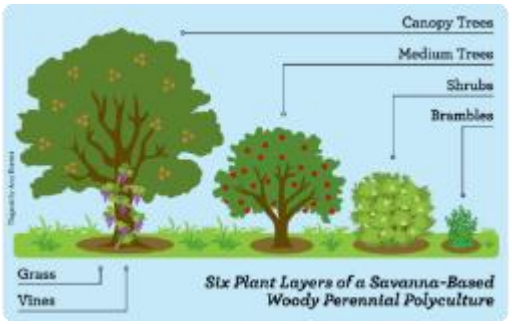
### 3. Business strategy

#### *3.a. What are the long-term goals and vision for the established farm?*

Mark’s goal is to create a farm patterned after the natural biome, but are capable of yielding staple food crops with more abundance and nutrition that annual monocultures. Thus, the farm will not only productive and profitable but will also create habitat for both domestic and wild species – a process of ecological restoration that although not 100% faithful to the historical biome, can still provide many ecological benefits.

This is done by substituting native trees and animals by other species with similar ecological properties, but of common use to humans. In the case of New Forest Farm, the relevant biome is an oak savanna, with canopy trees, medium trees, shrubs, brambles, vines and alley crops or grass for forage – see **Error! Reference source not found.**[90].

**Figure 5 - Savana-based perennial polyculture**




Source: http://wppresearch.org/theory/

Two objectives are to achieve a balance of pest and predator populations and to breed for new varieties able to thrive in the farm’s particular climate and soils, with minimum care. This will help the mature farm to remain productive while require a minimum of labor and inputs.

#### *3.b. What strategies are employed to increase revenues?*

Mark sees agriculture in the current context as inherently unprofitable: "In my seventeen years of restoration agriculture farming I have seen countless farmers (…) go broke and lose the farm. (…) They were smarter or they were younger. They direct-marketed, specialized, diversified, or some such thing that was their brilliant leg-up on everybody else. [They] lost their dreams and their life savings because they believed in the myth that agriculture could be profitable".

Mark’s strategy is to create over-yielding polycultures whose production goes up in time. This involves making profitable use of ecological niches: “Iris between the trees (…) used by a skin-care products company”[19]; “high-value timber should be given a priority”[19]; “plans are in place to gasify the wood and use the syngas to power an electric generator”[19]. He also grows annual crops such as squash and peppers which provide cash-flow. Mark also sells tree and shrub seedlings which a neighbor nursery grows from his seeds.[91]

He prefers “recognizable, marketable products [with] large, fairly consistent markets"[19] but also others “like geese, can have very high specialty market prices, but low total volume in sales". Furthermore, “by diversifying the species that one grazes, market fluctuations can be evened out. Cattle, hogs, sheep and poultry all tend to have slightly different price cycles.”[19]

Mark is able to sell most chestnuts and hazelnuts directly to consumers as he was the first grower in his area[92]. He sells certified organic produce through Organic Valley, now a large co-op with different product pools. Mark reckons this aggregation model is critical as “the economies of scale are moved to the processing level. A diversity of crops are harvested and delivered to their appropriate processing centers. (...) the farmers themselves are the owners of the processing and marketing company. As the company grows and sales increase, the farmer-owners receive a return on their original membership investment.”[19]

Mark argues that, in addition to “growing the future’s food and wood supply, we are creating beautiful, value-added real estate. (...) Restoration agriculture used solely as a real estate investment strategy is a powerful model”[19]. Areas of the farm are rented (to people raising sheep, chicken, produce, cows and pigs)[93] which helps to pay for the farm purchase.

Mark also earns fess from speaking, consulting and brokering products od other farmers.[91]

### *3.c. What strategies are employed to keep costs low?*

For Mark, “lowering the cost of production is absolutely key to financial solvency on the farm”.

His strategy is to have input costs go down as the system matures. He tries “to figure out how little you can do and still get away with it”[19]. This means he provides some soil amendments, weed control and water in the first 2-5 years of the plant, but after that, “chemical or organic, the grower of any crop — especially edible woody crops — who goes down the path of controlling pests and diseases by using inputs is fighting a losing battle”[19].

This planned lack of care is possible by managing the pasture and using (and developing) varieties and animal races that can thrive in the farm’s conditions with little additional inputs.

The system is designed to be harvested with standard industry equipment as much as possible, although the “ideal design would be one where the inputs for one crop would be accomplished by the harvest of another”[19]. Training apple trees as trellises for the grape vines not only saves materials, but allows for both to be (minimally) pruned at the same time, saving labor.

Because it is difficult to know at what scale it is efficient for a crop to be processed and marketed efficiently, the selling to an aggregator such as Organic Valley is important to keep costs low. Another, less evident, way Mark reduces his costs is by consuming the products he grows, thus avoiding to pay retail price (plus taxes).

### *3.d. What was the approach to establish and develop the enterprise?*

New Forest Farm was designed from scratch from the ruins of an overgrazed land. Not much details are given for the actual establishment of NFF but for perennial savannas in general.

The topography set the location of different features: “the swale-and-berm system is what sets the pattern of where woody plants will be planted (...) where roads and other vehicle or animal access lanes will be located, where fences will go, the pattern that grazing will follow [and] locations for infrastructure”[19].

But even without such a radical redesign, "agroforestry practices allow a farmer to continue to do what they are doing today while they install the perennials that will be the mainstay of their future."[19] This is done by planting trees on pasture or row crops, creating windbreaks and riparian buffers, by opening selected areas in a forest and growing useful species in the forest floor. Mark prefers to plant an excess of seedlings and varieties and remove the ones that don't bear at a young age, that are susceptible to diseases or pests or that crowd out each other. Mark lets plants self-propagate as long as they don't interfere with the rest of the system.

He uses sheep to control broadleaf plants that other species find undesirable but warns against goats, until the system is mature as they pose a great risk to young trees :"Grazing management needs to be especially careful when trees are young and sensitive, but is also necessary in later stages to maintain an open canopy that provides enough light for forage to grow."[19]

It is also noticed that in the initial years the yields are very low so the other components (e.g., animals and alley crops) are needed to provide an income. As the canopy grows, the space for alley crops diminishes but the production of the perennial plants increase.

#### *3.e. What strategies are in place to manage knowledge and people needs?*

Mark views restoration agriculture as "a system of techniques [where] farmers will be learning how to manage a system of crops with its own successional trajectory into the distant future."[19]

He reckons that such systems are complex and there is not much technical research available: "It would take a several thousand page book to address every biome in North America and to design a biome-appropriate agriculture system for each region. The work of ecosystem mimicry in agriculture should continue and someday each biome will have its own agricultural systems in place on the ground — complete with ongoing Ph.D. level research."[19]

Established agroforestry practices can help in the transition, but is up to farmers to experiment and develop new varieties and approaches. For this, "plant breeding is an essential skill and every farmer and gardener should at least have a little plant breeding knowledge."[19]

Mark does not discuss record keeping and information management aside for paying close attention to what plants are thriving and which ones are failing. Mark does not use interns in the usual sense of the word. Instead, he collaborates with people that set up businesses in his farm: "Our model is that you are a collaborating enterpriser. (…) You have your enterprise going on at this location and I have mine. We design our enterprises to be mutually supportive. When we do business-to-business transactions it's done at current market rates. (…) what you would call "interns" start their own businesses and earn whatever they can. They are self-supporting entrepreneurs. We help them get their biz started, then get out of their way. (…)"[91]. Mark views this approach as better in preparing "interns" to be future farmers and notes that "Eight out of 12 of our past summer folk have gone on to create their own Permaculture ventures"[91].

### 4. Operational details

#### *4.a. What are the main species present? What was the reason for their choice?*

NFF is modelled after an oak savanna, with six main layers. The main species used are:

- Chestnuts as the canopy tree as they are "a *Fagaceae* family member that bears every single year and also bears large crops"[19]. Hybrids of American and Chinese chestnuts are used, as

the former are too susceptible to blight and the latter fail in the coldest winters. Also, they "can be harvested mechanically by standard nut industry sweeping equipment, and basic processing companies and co-ops have sprung up in various regions of the country to complete the production cycle. Being high in carbohydrates and low in oil like the annual grains, chestnuts are the perfect staple food crop. Once dried they can be stored almost indefinitely. (...) Much like corn, they make an excellent industrial ingredient for food processing."[19]

- Apples (and pears) are used as the medium fruit bearing trees. Mark grows normal (not dwarf) varieties in 'the old way', with minimal pruning and letting animals browse the lower leaves and fallen fruits to avoid pests and diseases. Apples have large markets, and fruit not sold table consumption can be pressed into cider.
- Hazelnuts are used as a spreading nut-producing shrub. Hazelnuts are rich and oil and protein and can therefore take the place of legumes such as soybeans. The hazelnut shells and coppiced wood represent possibilities for energy production.
- Rubus (raspberries, blackberries) and Ribes species (gooseberries, currants) are used as the small bush/cane fruits that grow in the sunnier (the former) or shadier (the latter) sides and can be harvested commercially with a straddle-harvester.
- Grape vines are grown along with some apple trees that are pruned to form a living trellis.
- The understory is mostly composed of grasses for grazing and mushrooms, which are more shade tolerant and can fetch good prices.

Other plants also grown include white oaks, walnuts, cherries, kiwis, mulberries, rugosa rose, Siberian pea, iris, asparagus and annuals such as squash, sunflower and peppers. 15-20 sugar maples are kept for home use and gift item[94]. Mark refers a wide array of plants that can be used in different climates, but is unclear which of those he actually grows. The domestic animals present are cattle, hogs (Tamworths, for their forage ability), chicken, sheep and geese.

#### *4.b. How are soil, water and nutrition managed?*

Water is managed mostly with the help of topography: due to the keyline swales, ridges are now the wettest areas at NFF[95]. However, some newly established trees are also irrigated with drip tape. A subsoiler is used to decompact the soil, promote aereation and prune roots of trees.

Mark prefers to adapt plants to the soil rather than the other way around: "knowing the actual mineral composition of your soil will help you to guide your plant variety decisions, and a quality soil test is recommended". However, he does use soil amendments to help some plants getting established. He also pre-inoculates tree roots or transplanting water with mycorrhizal fungi, "especially if they are planted in former annual crop land where fungi are scarce and where bacteria dominate."[19]

Animals are rotated in pasture in leader-follower systems. Ruminants eat only forage, sprouts and leaves, but pigs (bought with 30lb) and chickens are fed a minimum of local organic-grown grain/ration to be alive. However, they must forage for themselves. As the summer progresses there is an abundance of nuts, fruits, insects and discarded produce.[96] While foraging and browsing, the animals also provide fertilization with their excrements.

As with plants, “Supplemental feeding of minerals and trace elements should be carefully monitored. (...) Soil testing and forage testing is prudent in order to understand what your soil mineral levels actually are doing. Don’t lose your herd or flock to guesswork.”

### *4.c. How are losses to pests, diseases, weeds and predation managed?*

Mark “is not in the bug-killing business”. He copes with pest and disease by breeding resistant varieties and creating a rich and diverse system that strives for ecological balance of pests and predators”[97]. The spatial distribution and animals foraging fallen leaves and fruit help to break fungi cycles. Animals also and turn losses (e.g., dead nuts and apples) into inputs.

Establishing trees are protected from animals with fencing. Mark uses some ‘recipes’ such as eggs mixed with water to prevent dear from browsing young trees, but remarks that in the end it the sheer number of planted trees that assures that many will survive deer and rodents.[94]

Animal health is managed through rotation, separation and diet: "To limit parasite and disease transmission keep cattle separate from pigs and pigs separate from the fowl and fowl separate from the sheep. Care should be taken that animals are not stressed. Clean water should be available to the animals at all times and watering tanks or troughs should be emptied and purged between species. (...)Parasite problems can also be limited by maintaining a diverse pasture mix and especially a mix that includes perennial plant species that are known to be parasiticides (...) Healthy pasture with long periods of recovery between grazing is the best way to maintain healthy, parasite- and disease-free livestock.”[19]

### *4.d. What type and how much energy is use and generated at the farm?*

The farm is entirely solar and wind powered and farm equipment is powered with locally produced biofuels that are not taken from the human food chain[89]. The farm generates plenty of biomass that can be used to generate energy: "within ten years, wood was in abundance. Within 15 years it began to pose a challenge. How can all of this wood be utilized? (...) plans are in place to gasify the wood and use the syngas to power an electric generator. (...) our calculations show that one acre of hazelnut shells, for example, should produce nearly $90.00 worth of electricity per acre if sold."[19]

### *4.e. What is the main equipment/infrastructure used?*

There is not much information about the tools used. He notes that the swale/berm system was designed with help of an A-frame[95] and new trees planted with help of a mechanical transplanter and irrigated with drip tape[94]. Mark uses second-hand subsoiler used on the pasture. He does not use harvesting machinery as the areas do not yet justify that investment.

### *4.f. Other production details*

Nuts are harvested mostly by hand. Chestnuts are picked off the ground with hand-held tools and the hazelnut acreage and yields do not justify buying a machine.[92] Mark keeps hives of honeybees, but “they are far outnumbered by wild pollinators. In apple or cherry blossom season the trees are swarming with pollinator insects of all kinds while a few honeybees can be seen as well”. Bees are managed in ‘the old way’ to create strong colonies and interrupt disease and pest cycles: “Every year we divide our honeybee hives, once per hive, twice if the hive is incredibly strong. We extract the honey and leave enough to hopefully carry the hives through the winter. If a hive does not survive the winter, or dies from some other cause, so be it.”[94]

## 5. Production and Profitability

### *5.a. How much does the farm produce? What inputs go into that production?*

No values are given for the total output of the farm. However, Mark compares the calorie output of a typical acre in NFF with that of an average corn monoculture. In addition to calories, this system also produces protein, oils, and minerals and vitamins, which are not quantified here. The analysis considers the use of some wood biomass for mushroom substrate, but not the full production of wood and hazelnut shells.

**Table 4 - Mark's assumptions of the energy potential of 1ha of New Forest Farm**

| Plant / animal (#/acre) | | Yield | Energy | Energy / acre |
|---|---|---|---|---|
| Chestnut trees | (86) | 1000 lbs/ac | 1,088 Kcal/lb | 1,088,000 Kcal |
| Apple trees | (34) | 84 lbs/tree | 235 Kcal/lb | 671,160 Kcal |
| Hazelnut shrubs | (208) | 2 lbs/plant | 2,939 Kcal/lb | 1,222,707 Kcal |
| Raspberry canes | (416) | 1 qts/plant | 256 Kcal/qt | 106,496 Kcal |
| Redcurrant bushes | (520) | 10 lbs/plant | 255 Kcal/lb | 1,326,520 Kcal |
| Grape vines | (120) | 5 lbs/plant | 306 Kcal/lb | 183,408 Kcal |
| Mushrooms | | 379 lbs/ac | 90 Kcal/lb | 34,019 Kcal |
| | | | | 4,632,310 Kcal |
| Dairy cow | (1) | 6 gal/day | 2334 Kcal | 14,005 Kcal |
| Beef steer | (1) | 569 lbs/yr | 852 Kcal/lb | 484,788 Kcal |
| Pig | (2) | 184 lbs/yr | 907 Kcal/lb | 333,850 Kcal |
| Chicken | (10) | 3.9 lbs/yr | 1,008 Kcal/lb | 39,299 Kcal |
| Sheep | (2) | 80 lbs/yr | 1,231 Kcal/lb | 196,988 Kcal |
| Bee hives | (4) | 50 lbs/yr | 1,382 Kcal/lb | 276,480 Kcal |
| | | | | 1,345,410 Kcal |
| **Total** | | | | **5,977,720 Kcal** |

Notes: Hazelnut yields refer to kernels only. Pigs and chicken are fed some local organically-grown grain/ration

The yields considered in this analysis are not actual yields at NFF, but yields that he expects from a mature Restoration Agriculture farm once appropriate cultivars have been developed.

Mark considers that "many plants yield just as much in polycultures as they do in monocropped systems (...). Unfortunately, there is no technical research data available as of yet showing that a savanna-analog, restoration agriculture cropping system can actually increase total food yields. This is merely because so few restoration agriculture systems exist and little to no research is being conducted on them".[19] The values taken are considered to be on the low end of what is expected in monocultures.

For corn, the following values are presented. The category 'other' was added to balance Mark's calculations, which not always add to 100% of the values presented.

**Table 5 - Mark's calculations of corn's energy that is used as human food**

| | Amount used | Share | Kcal used | Share | Conversion to food | | *Notes* |
|---|---|---|---|---|---|---|---|
| Livestock feed | 5,250 Mbu | 43.4% | 5,900,000 Kcal | 42.4% | 5.4% | 318,600 Kcal | *Chicken conversion to carcass weight is higher (~33%)* |
| Biofuel | 3,650 Mbu | 30.2% | 4,200,000 Kcal | 30.2% | 0.3% | 11,340 Kcal | *DDGS yield is 30-40%, and more energetic than corn* |
| Industrial ingredients | 943 Mbu | 7.8% | 1,070,000 Kcal | 7.7% | 100% | 1,070,000 Kcal | |
| Export | 1,850 Mbu | 15.3% | 1,400,000 Kcal | 10.1% | 100% | 1,400,000 Kcal | *Some of the exported grain may be used as animal feed, thus lowering this value* |
| Human consumption | 327 Mbu | 2.7% | | | | | |
| Other | 80 Mbu | 0.7% | 1,330,000 Kcal | 9.6% | 19.6% | 260,060 Kcal | *Category 'other' added to balance Mark's calculations* |
| **Total** | **12,100 Mbu** | 100.0% | **13,900,000 Kcal** | 100.0% | | **3,060,000 Kcal** | |

Assumptions:
*USA Production (2008) = 12.1 billion bushels*
*Average corn yield = 150 bu/acre*
*Energy content of corn = 93,246 Kcal/bu*

*∴ Even assuming all exports and industrial ingredients are used for food, we would be short of Mark's 3,060,000 Kcal. But assuming a 10% conversion rate for animal feed and a 30% use of distillers' grains (=3% as human food), we would get somewhere between 4,000,000 - 5,000,000Kcal*

### 5.b. What are the main imports and exports of nutrients to/from the farm?

Some amendments are used, mostly when establishing new trees: “At New Forest Farm calcium phosphate has been applied to address a phosphorus deficiency and balance the calcium-magnesium ratio (…). Elemental sulfur has been added to create a slightly more acidic soil and to assist with protein synthesis in the chestnut rows. Various trace minerals such as selenium, zinc and boron have been regularly added to make up for their deficiencies”[19].

Pigs and chickens feed includes local organically grown rations and cereals, and, as there is no indication that animals are bred on the farm, one assumes they are purchased. Apart from these, NFF uses little external inputs, as energy is also produced on the farm.

Nutrients leave the farm in the form of products, as animals are processed off farm, but leave their manures on pasture.

#### *5.c. What is the profitability and cash flow of the enterprise like?*

Mark separates the analysis of the farming business from that of owning a farm (which he sees as real estate business). The farming business (which pays rent to the real estate entity) has been profitable to pay for itself and reinvest in itself for the past 20 years. There were some years that were not profitable, particularly when it was necessary to buy much tree material or equipment [Mark seems to conflate profitability with cash flow]. The real estate entity receives rent from the farming businesses and according to mark is also appreciating in value[93]. This distinction is critical for Mark as he argues that no single farming venture itself can pay for the cost of real estate investment.

The author notes that the average costs with an acre of corn (250$/acre) are much higher than the costs with his the oak savanna: “in 2010 the annual production costs came to a grand total of $8,672.00, or $86.72 per acre. This is a mere third of the production costs of an annual crops farm. (…) most of the expenses were incurred from the planting of 6 acres of annual crops”[19].

He argues that chestnuts profits compare favorably with corn: "Take corn at the $8.00/bushel selling price x 150 bushels per acre = $1,200.00 per acre in gross revenue. The $1,200.00 per acre gross revenue minus a $250.00/acre cost of production = $950.00 net per acre. (…) Chestnuts at the $5.00/pound selling price x 1,000 pounds (…) per acre = $5,000.00 per acre in gross revenue. The $5,000.00 per acre gross revenue minus a $83.00/acre cost of production = $4,917.00 net per acre. This calculation assumes that chestnuts are sold directly to customers at 5$/lb[92].

## 6. How does the farm fit in the community and surroundings?

#### *6.a. How does the farm fit with the surrounding landscape and wildlife?*

NFF stands out from the neighbor row crop monocultures. Mark view his approach as a conservation practice in itself: “A restoration agriculture system (…) doesn’t really need habitat islands, simply because it is a habitat island. A restoration agriculture system has a wide diversity of perennial plants providing multitudes of microclimates and habitats for beneficial insects, amphibians, insect-eating birds, and more”[19]. This results in a high diversity of wildlife: “Recently two researchers from the University of Wisconsin-Madison walked the long grassy driveway from the road to our farmhouse and counted twenty-seven species of birds in a mere 1,300 feet. They continued their census throughout the day and added many more to their total.”[19]

*6.b. What do you clients and neighbors say about the farm and the farmer?*

This is not addressed in Mark's book, but he tells a story of a silvopasture dairy farmer, that, in contrast confinement operation next door "influenced untold hundreds of suburban kids and has provided them with a lifetime of beautiful memories. His system has acted as an ambassador on behalf of beautiful, ecologically sound, and humane farming for years and it will exist for centuries in the memories and family stories of those who were touched by its pastoral beauty."[19]

Mark is open to the community but does not 'force' it: "We have a steady stream of casual visitors (..), organized tours, alumni, close friends as well as customers. (...)We don't attempt to force reality to conform to our personally held concepts of what a community should be, we accept it for what it is. Those who are not attracted to interacting as sovereign enterprising individuals (...) don't fit in here and they select themselves out."[91]

Mark also collaborates with neighbors in businesses and interacts with other farmers through workshops, consultations and friendly discussion.

*6.c. What do critics say about the farmer's approach? What is his answer?*

Mark discusses the potential objection that perennials cannot 'feed the world' as annual grains: "By asking us restoration agriculture farmers the question, 'Can you feed the world?' what they are really asking is, can we produce 13.9 million calories of food per acre in a savanna-mimicking restoration agriculture system?"[19], which he then goes on to prove. He also adds that "the current system is not feeding the world and increased yields of the same crops alone will also not feed the world. One of the reasons for this is that monocrop systems of annual grains do not have enough nutrition in order to feed people. (...) If the bellicose corn farmer insists that we need to grow monocrops of annual plants in order to feed the world, then he or she had better set aside some more acreage to grow enough other plants in order to supply these essential nutrients[19].

### 7. What are the farmer's views on agriculture, food and society?

Mark's main concern is that "Every human society that has relied on annual crops as staple foods in their diet has collapsed. (...) Our own modern culture is on the same trajectory as these ancient civilizations. Our fossil-fueled farm equipment and our chemical fertilizers have allowed us to do the work of destroying ecosystems faster than any other culture to date. In less than 400 years, the North American continent has changed from a "wilderness" of health, vitality and abundance to a near ecological corpse."[19]

He views farming and ranching as solar energy collection businesses. From this viewpoint, monocultures are not generally efficient, as they collect much less energy than polycultures. Annual crops are particularly inefficient as they require either fossil energy or labor, inputs and because of tillage, increase the risk of soil erosion. Annual crops, however, are major sources of carbohydrates, proteins and oils in the human diet. A change to perennial polycultures must therefore provide the necessary staple foods for a human diet.

Mark argues that agriculture in the current system is inherently unprofitable – most farmers require subsidies and take second jobs. However, this does not mean that farming is impossible: "Your agricultural enterprise probably will not pay all of your bills. Don't beat yourself up over this. (...) This doesn't mean don't get into farming or ranching. (...) Rural life is

incredibly rewarding and despite the fact that farming doesn't really pay, we can figure out how to stay in the countryside, stay on the farm and live a good life."

A change to a better system is urgent: "We must stop the endless "blame game" and the pointless debate about whether these problems are human caused or not (…) You and I didn't personally cause the depletion of oil, the disruption of the global climate, or the loss of water resources, but we are part of a system that collectively contributes to these problems. Our culture as a system is a significant factor in all of these problems, and it is that system that we must change around us from the top-down, bottom-up and inside-out simultaneously."[19]

### 8. What other information is worth noticing?

The author suggests that the biome proposed is not fixed but adaptable to other types of savannas in colder and warmer regions. He also provides possible perennial associations for other biomes such as "temperate riparian zones" "northern pine forest" and "boreal forests" (the author states that the possibilities for subtropical and tropical areas are even higher due to the numbers of edible perennial species).

## RICHARD PERKINS – RIDGEDALE PERMACULTURE

### Summary of the approach followed

Ridgedale is a ~9.5ha family farm where silvopasture production (currently eggs, chicken, sheep and dairy) is complemented by education and consulting. The farm's layout and activities are designed for the long term improvement of the landscape and carefully monitored and fine-tuned over time. The goal is add multiple income streams (vegetables, mushrooms, nursery stock, tourism, etc) that allow the farm to mature with a balanced cash-flow while providing a diverse set of high quality local products and building close ties with the local community.

### Data collected

#### 1. General characteristics and context of the farm

*1.a. Where is the farm located, and what are the climatic and biotic characteristics?*

Ridgedale is located in Sweden at 59°N. The nearest town is Sunne (5,000) at 17Km and the nearest city is Karlstad (87,000) at 60Km. The climate is temperate, with snowy winters, warm/cool summers and regular rainfall (lies between Dfb and Dfc in the Koppen-Geiger classification[76]). Located in hardiness zone 5/6, temperatures can go below -20°C in winter. The farm lies in the border of boreal forest and temperate broadleaf/mixed forests biomes[75].

*1.b. What are the main features of the farm*

Ridgedale's ~9.5ha farm comprise 4.8ha of silvopasture and 3.6ha of forest. The agroforestry area is composed by both nut savannah fields and multi-species alleys arranged in a keyline pattern. Three rows of willows in the south border, coppiced in alternate years provide windbreak and fire wood. Layer hens, cows and sheep graze in between under high intensity rotational management and broilers are pastured in portable pens. The forest areas are composed by old-growth spruce forest and reforestation with mixed broadleaf species. The landscape features gentle hills that become steeper near the two streams that cross the property. The built area comprises two houses, two barns, a workshop, a root cellar, a polytunnel and kitchen gardens.

*1.c. What is the farm's history and surroundings?*

Richard and Yohanna purchased the farm in late 2013. The previous owners were a thrifty, self-sufficient elderly couple who lived off the land and farmed with horse-drawn implements. They grew wheat and raised pigs. It is not clear if they grew the wheat just for themselves and the animals or also for sale, as the farm is smaller than commercial wheat farms.

The neighbor in the south has a permanent pasture from which he cuts hay for sale (although he has a fully equipped dairy barn) and collects subsidies (which are being phased out though). The rest of the neighbors rent summer houses or keep forested areas, but basically nobody farms, although they have the land to do so. Down the road, in the village there is a big, non-organic dairy operation (5,000L day).

**Error! Reference source not found.** and **Error! Reference source not found.** provide a visual overview of the farm and surroundings.

**Figure 7 - Aerial overview of part of Ridgedale (buildings and silvopasture fields)**

Source: http://www.ridgedalepermaculture.com/agroforestry.html

**Figure 6 - Map of existing and planned features at Ridgedale.**


Source: www.ridgedalepermaculture.com/design-at-ridgedale.html

## 2. Farmer's description

### *2.a. Farmer's biography*

Richard holds a Higher National Diploma in Organic Crop Production from Lackham College. He attended a MSc. in IESD at Gaia University and is a permaculture teacher certified by the PRI of Australia and the Permaculture Association of UK.

He has worked in different parts of Europe, Asia and Central America and is experienced in the design and implementation of diverse systems, from Veg- box production, whole-farm planning, agroforestry, edible forest garden systems, water catchment, treatment & irrigation systems, bioconstruction, Keyline® design, Holistic Managed Grazing & planning and community building work.

Yohanna, who co-owns and co-manages the farm, has a degree in gardening specialized in Health and Design from the U. of Gävle (Sweden). She is experienced in accounting, and management and pioneered community and eco-village initiatives near Stockholm.

### *2.b. Where does the farmer find inspiration and information?*

The major pillars that inform Richard's work are Holistic Management, Permaculture and Keyline Design. Regarding specific individuals, Richard is particularly inspired by the work of Joel Salatin (in the development of low-cost/fast response enterprises, and clearly sharing operational detail and figures), Allan Savory (in the use holistic management not just for management of grazing areas, but the entire enterprise) and P.A. Yeomans (use of keyline design and scales of permanence to design a property).

Other influences are Mark Shepard and his approach to agroforestry, Jean Martin Fortier in market gardening and, in general, people that are succeeding at a disadvantage vis-à-vis the conventional model and sharing their experiences and results in a replicable way.

### *2.d. What values are fundamental to the farmer? Where is he willing to compromise?*

Richard feels he does not have a clear red line of what he can or cannot do, and that he is very flexible to do different things depending on the context. While he can hold certain philosophical conceptions, what makes a small farm succeed is hard work and pragmatism

For example, while aiming to exceed organic standards (which is not hard as many are not particularly exacting, for smaller scales at least), he does not follow organic standards to the detail. For example, he would like to provide his chickens with organic feed, but this has soya protein and not meat protein – is that better for the physiological needs of the animal? Also the broilers are raised on pasture, but they come from industrial hatcheries, which are the ones available. Or in the case of vegetables, while he does not use insecticides for domestic consumption, in the case he runs a CSA in the future, he may need to use organically certified insecticides if absolutely needed to supply customers and secure income.

Ultimately the objective is to restore soils, habitat and life supporting systems, which includes their economy and community. Although he may accept some sub-optimal decisions, he is aiming for more optimal ones. Meanwhile, the customers still have access to much better products and the farmer is able to stay competitive. This said, Richard would not use non-organic certified chemicals in the farm, GMOs, prolonged animal confinement, or methods that would degrade soil condition.

## 3. Business strategy

### *3.a. What are the long-term goals and vision for the established farm?*

The stated objectives are: *"Our foremost responsibility is regenerating our landscape, ecosystem processes and soils through resilient, replicable, scalable and profitable farm enterprises. Our secondary function is to educate, facilitate, inform and empower people into action through regenerative design, enterprise and holistic decision-making that fosters and stimulates local community, economy and resilience".*

To achieve these goals in the long term, Richard envisions several features over the long term.

The operation will be even more diverse and self-reliant in terms of inputs, continue to improve both pasture and forest, and move to more energy efficient animals with ducks/geese/rabbits replacing or complementing the broilers and pigs raised mainly in the brush areas under reforestation. Richard would also like to rent neighbors' lands, as they are too small for commercially raising larger herbivores such as sheep or beef cows.

The nuts, apples, hazels and bramble fruits provided by the agroforestry trees and bushes will be suitable for a "pick-your-own" system that is not labor intensive. A pond, dug in the steeper hill near the road, will provide habitat for wild species and create a micro-climate to grow vines. Other ideas are to produce vegetables to be sold as part of a CSA or similar, building a couple of cabins in the forest for tourism, growing mushrooms and growing nursery trees for sale.

The farm will soon shift towards more production and less educational services. The focus will be in informing and educating customers and neighbors, as the integration in the local community is an important pillar of Ridgedale's operations. The farm is also meant to provide for most of the family's needs: for example, the cows will be maintained to supply the family's consumption of milk, cream and butter. Another goal is to find a balance between the workload that the farm chores and education demand and having time off for the family.

On a broader picture, Ridgedale attempts to show that if it is possible to make a good living while improving the land in such challenging conditions (short growing season, expensive inputs and strict regulations are serious difficulties; engaged and affluent clients are a plus, though) it should be possible to do it in many more situations.

### *3.b. What strategies are employed to increase revenues?*

Ridgedale's strategy to increase revenues lies in having multiple complementary income streams, improving the ecological relationships for future productivity, and obtaining the most value of the products sold though quality and client relationship.

Providing high quality local products directly to clients allows to obtain the full margin of a premium price (similar to high-end organic products in supermarkets) price in both eggs and chicken. To assure the quality of the product and keep the entirety of the margin at the farm, the chickens are butchered and processed at the farm, which required investing in a dedicated inspected facility.

A key decision was to plan the production of the farm around common products that everybody eats – chicken and eggs – rather than more exotic products such as geese (although these may be produced in the future). In this sense, Ridgedale aims at a growing niche (high quality, healthy and ethical) of a big market (chicken and eggs) rather than a big share of a small

market (e.g., geese). Another important characteristic of these productions is to have a quick cash-flow return.

Clients are encouraged to visit the farm on specific days and to pick their products, although sales are also done in farmers' markets in Sunne and drop-off points in Sunne and Karlstad. Chickens are pre-sold using a "virtual currency", the Ridgedaler (which sounds like an old Swedish currency, the Daler, which reserves a bird of two kilos (carcass weight). As birds usually have 2.4 kilos, the remaining is settled on delivery.

Educational activities provide another important income stream. In 2015 Ridgedale ran two Permaculture Design Courses with ~40 students in total and two 10-week internships with ~20 interns in total. Prices for the PDC are 7000-9000SEK and for the 10-week internship are 33,500-39,000SEK. Richard also provides trainings and consulting services in Sweden and abroad, particularly in winter.

On the other hand, the farm is carefully managed to constantly improve the value of physical and natural assets of the farm, therefore improving the future context of the operation.

### *3.c. What strategies are employed to keep costs low?*

Ridgedale uses several strategies to keep investment and costs low.

One is to use appropriate technology effectively. This means that simpler tools that can get the job done are preferred to more complex and expensive ones. So, for example, although Richard has a wide array of quality hand tools and uses portable electric fence, he does not own a tractor, hiring one when necessary, and buys hay for the winter from a neighbor, as hay-making requires dedicated machinery (if he is to take on long-term leases on neighbor lands, he might considering acquiring haymaking equipment or contracting haymaking).

Another strategy is to make at the farm or obtain second-hand/freely tools (not uncommon in Sweden), machines and buildings instead of buying. This is seen in the setting up of the processing plant from a mobile house structure. It also applies to growing trees from seed when appropriate.

The pre-purchase of the chickens by the customers also helps to produce just the right amount of chicken that are to be consumed/sold and keep the feed costs.

Things that need to be bought are often procured from abroad (often UK) where they are much cheaper (usually before 2 and 5 times cheaper and up to 10 times cheaper in case of young trees).

Also important is the synergy between the education and the production roles of the farm. Interns participate actively in farm chores and provided help in labor intensive activities, such as tree planting. However, they also require an investment in both catering, tool costs and time to teach/oversee. More important is the core team of apprentices that reside at Ridgedale for a growing season. The expense and time spent in training them is repaid in the later months when they take an important part of the day-to-day running of Ridgedale while adding a more diverse set of skills.

*3.d. What was the approach to establish and develop the enterprise?*

When the farm was bought it was not much developed (just pasture and basic buildings), so much work and investment were required.

The first year consisted mainly of observing, designing, implementing critical investments and also some educational activities (three PDCs and two internships). Observing and understanding the place was important as prior to the purchase Richard had only seen the farm covered in snow. The design approach follows Yeoman's scale of permanence, in which the most permanent features of a site are thought of ahead of less permanent ones (climate → water → roads → trees → buildings → fences → soil). The actual order of implementation may differ, but the planning is done beforehand. At Ridgedale most fences and trees were set up in the first year while building construction and soil improvement is an ongoing process. The creation of ponds is planned for the future.

In the second year (2015) Richard kept with educational activities and increased the production of broilers (~1000 birds) and layers (~350 hens). The most important investment was the setting up of an inspected processing facility that allows chickens to be killed and dressed in the farm. Other investments include improvements in farm buildings and in the mobile chicken coop, planting hops and vines, and the construction of a tree cabin in the woods.

For the third year (2016), Richard plans to direct more energies towards production (progressively increasing the number of layers to two flocks of ~500, of broilers to 2000-3000 and creating a vegetable CSA) and slightly less in education (2 PDCs and 1 internship program). Richard will maintain a core team of volunteers and experiment hiring a full-time employee to take on the management of certain processes, leaving more time for Richard to concentrate on other activities.

The purchase of the farm and initial investments were considerable so further investments are planned to come from future results and from low-cost approaches (explained in point above), to maintain debts at a minimum.

The quick pace of establishment and growth at Ridgedale have been helped by Richard's previous experience, the availability of information (e.g., support networks, books, websites) and the synergy between educational and production activities (as explained in the point above). However, it was critical to have a clear picture of the desired future and a methodology to achieve it. Also critical was the ability to visualize every important step and plan things thoroughly. Working this way, the planting and mulching of the trees only took one week, but had much forethought behind it.

*3.e. What strategies are in place to manage knowledge and people needs?*

Careful recording of information, analysis and planning are critical to Ridgedale's success.

Daily record keeping of operations and changes permits comparing results of different approaches and continuous improvement. Different compositions of chicken feed are tested and results recorded and attention is also given to the pasture. In 2014 one of the core team members studied the pasture quality extensively, including the species growing in pasture[98,99], the influence of grazing management in the pasture[100] and relationship between chicken rotation and growth of fly larvae and dung beetles in cow pats[101].

Holistic Management is used to clarify the context, goals and priorities of the entire operation – opportunities are analyzed in the context of the multiple objectives desired and resources available. It is also used to manage the intensive rotational grazing for which it became initially known: soil, pasture and animal conditions are evaluated frequently and the practices adjusted accordingly. The winter, when work is less intensive, is the time to review the workings of the previous year more carefully and to plan for the next year – and iterative process that requires going through plans many times.

The learning process is done both through literature, interaction with other people and on-farm experiences. Richard's extensive library covers several topics including agriculture, design, construction, philosophy business and economics and spirituality.

He learns both through the interaction with neighbors, interns, students and people all over the world through social media. He also does consulting and trainings abroad and in the process interact with other practitioners. Richard is also experimenting with different plants, hen house and beehive designs, different composition of compost teas and biological soil amendments. Some will prove more suitable for the particularities of the local climate and farm features, others will be changed or discarded. An important feature is that these experiences are gradual or small and none creates a big loss potential.

Richard likes to have people in the farm. He reckons he could run the farm alone with Yohanna and occasional help, if he focused only in the production. However, he prefers to have a team of 6-12 apprentices that work with him for 6 months, from April to October. These and run many of the daily chores, particularly when there are students at the farm. To attract these people Richard is committed to provide them with a meaningful learning experience in exchange for their work. Observation and informal conversations with the apprentices reveals they are satisfied with their tasks, living and working conditions and their learning experience. Indeed, one of the two permanent workers that Richard will employ in 2016 was previously an apprentice at the farm.

## 4. Operational details

### *4.a. What are the main species present? What was the reason for their choice?*

The two cows and calf at Ridegedale are Swedish Mountain Cattle. They provide the family and guest with dairy supply, not commercial production. They were chosen because of being small, hardy animals that don't need heated barns, eat half as much as a modern dairy cow while producing less milk but with double fat and protein content. Therefore they are efficient and well suited for milk cream and cheese at a homestead level.

The meat chickens, on the other hand, are Cornish Cross, which is the race commonly used by large producers. These birds were chosen in part because of being the only ones available from commercial hatcheries, but especially due to traits such as food motivation and rapid growth. These make them gain weight much faster than others (about 8 weeks from chick to processing).

Similarly, the ~350 egg layers are Lohmann Browns which are one of the most common laying chicken breeds.

If the chicken were raise only for domestic consumption, Richard would have likely opted for hardier landraces. For commercial production, however, these would take much more time and feed to achieve a similar weight and would therefore be too costly to clients.

The 14 sheep are of different meat breeds (Devon, Sussex and other Swedish races) and also raised for domestic consumption. They time the lambing time for January so the lambs are slaughtered when there are plenty of people at the farm.

There are at least 37 different species of grass, legumes and broadleaf plants growing in the pasture (2014 survey)[98,99], their composition varying somewhat from field to field and according to season. These were already present in the field as Richard did not re-sow any of the fields.

The planted component of the silvopasture includes tree crops (apple, pear, plum, cherry, chestnut), shrubs (Raspberry, blackcurrant, redcurrant, gooseberry, hazkap) and several marginal and contour plants (goji berry, japanese quince, edible rowan, chinese mahogany (leaf crop pollard), european lime (leaf crop pollard), mulberry, elder var., juneberry, chokeberry).

The tree beds were also sown with a mix of over 40 plant species that aiming at providing soil protection, nitrogen fixing, nutrient accumulation and pollen and nectar for insects. The windbreaks are composed of 3 rows of willow which are coppiced in alternate years. The existing forest is composed mostly of spruce, but the reforesting areas contain several species such as oaks, ash, rowan and birch-cherry.

### *4.b. How are soil, water and nutrition managed?*

The two main processes influencing soil and water resources are the patterning of fields according to keyline design and the rotational grazing with cows, sheep and chickens.

The forestry components of the farm are laid in a keyline pattern that uses topography to optimize the water flow. The pastures are ripped every year with a subsoiler according to the keyline pattern which contributes to better soil structure through de-compaction and increased porosity. This helps water to infiltrate were it lands, thus contributing to more even distribution of water in the landscape.

Much of the domestic greywater flows through a succession of small ponds to be purified and later used in the vegetable patch. There is a compost toilet which is used by all the interns, students and also family and core team. The resulting material is cured for 18 months and later used to fertilize the trees in the silvopasture.

The managed rotational grazing component is intended to promote pasture growth and health. The animal manure is evenly distributed throughout the fields at the time that grass can make most use of it: when it is ready to enter a period of fast growth after being grazed by cows and sheep. Chickens (who are given calcium-rich oyster shells for grit) add manure as well and also help to spread ruminant manure.

Ruminants graze the pastures from about late April to early November (exact dates will depend on weather and pasture conditions). During winter, they are fed hay (and some silage for the sheep) bought from a neighbor. They also have mineral nutrients mixes available, to prevent nutritional deficiencies and, with time, returning the lacking nutrients to the soil through their manure.

The chickens derive a portion of their nutrition from the pasture, either from insects and fly larvae hatching on ruminant manure – the layers move into the paddocks cows and sheep were some days before to take advantage of the fly growth cycle[101]. They are fed cereals (wheat, oats and, in the future, naked oats) that are grown organically by a neighbor and also pre-mixed commercial feed. The layers receive only pre-mixed organic feed while the broilers receive a mix of organic and non-organic rations. This happens because the protein content is particularly important for the broilers they raise, and pre-mixed organic feed does not contain animal protein. They are testing with different ration mixes for the broilers and hiring a poultry specialist as a consultant to help find a good solution, because custom mixes are only available in bulk orders and they don't have (and don't necessarily want to have) silos to buy in bulk and store. The feed mix provided is the same throughout the bird's life, again because mixes for different growth stages are only available in bulk, and the birds appear to be fine as they have access to outdoors and supplementary sources of protein from the pasture.

*4.c. How are losses to pests, diseases, weeds and predation managed?*

Richard approach to healthy animals is to provide healthy nutrition and living conditions and the key to this is the pasture rotation. Providing animals with fresh forage every day, adequate feed and nutrient supplements and clean water (in clean waterers and feeders) helps to boost the animals' immunity systems.

The movement in pasture prevents the accumulation of manure and pathogens and animals are not packed too tightly together (paddocks for cattle, sheep and layers are usually about 60-100m$^2$ depending on the season and broilers have about 12m$^2$ for 50 chickens) which helps to prevent pathogen transmission. Although higher densities might be viable, that might put off some customers and maximum efficiency is not necessarily what Richard wants to aim for.

The portable electric fences also keep domestic animals in and predators out. Layers are sheltered in an 'eggmobile' during the night while broilers are protected in a pen which also shelters them from the wind.

The periodic intensive grazing leads animals to not be too selective about their food and therefore to eat or trample less desirable plants and preventing them from multiplying (although it is necessary to periodically scythe the willows that insist on growing on the pasture). Planted tree are protected from animals both by the electric fence and individual plastic protection.

Permanent fencing prevents elk, deer and wolves from entering the pastures. Although it has not been an issue, if there were problems with berry fruits, they would resort to physical methods netting).

Richard plans to base the health of the CSA vegetable garden primarily through good nutrition (compost+crushed rock+oyster shells), rotation and compost teas. Water for the gardens comes mostly from the well, when necessary. Pests are dealt mostly by rotation and exclusion (netting). However, if serious pest or disease risk compromising the harvest, he will consider applying organic-approved methods to prevent crop failure. If such comes to happen, the reasons will be investigated to understand what went wrong and how can it be improved.

*4.d. What type and how much energy is use and generated at the farm?*

This information was not available at the time of the interview.

*4.e. What is the main equipment/infrastructure used?*

Ridgedale is a highly diverse farm and Richard favors using appropriate technology he can make or repair himself as much as possible. Therefore equipment tends to be more simple and versatile than highly specialized or complex. The most important elements are:

- Portable, lightweight electric fencing to manage rotational grazing, keeping animals in and predators out;
- A small All-Terrain-Vehicle (ATV) and trailers to move things around;
- A portable chicken coop built on top of a trailer for the layers and portable 3x4m pens for the broilers;
- A subsoiler and a bedformer, used to keyline plow the fields and set the beds for the keyline tree plantings and the vegetable garden;
- An inspected slaughter unit made by adapting a trailer-home;
- A hoophouse used for growing tomatoes and cucumbers;
- A workshop and many quality hand tools that allow Richard to build, repair and manually do many of the daily tasks.

Richard does not own a tractor or a haymaker. When needed, he rents these services from neighbors.

## 5. Production and Profitability

*5.a. How much does the farm produce? What inputs go into that production?*

It is difficult to quantify the total production at Ridgedale due to the multiplicity of goods and services produced, on-farm transformation and on-farm consumption (relevant as the farm also feeds a large core team, interns and PDC students. The data for animal products and consulting/training hours is fairly accurate while data for vegetable, fruit and timber produced is estimated, as these will only be sold in 2016.

A precise amount of the inputs and resources consumed was also difficult to obtain. The major inputs to the farm were the feed and grain for the meat broilers and layer hens. Other relevant inputs are food/tools for the PDCs and internships, construction materials, straw for winter bedding and hay for winter feeding. The part of production consumed by guests (interns, PDC participants and core team) was considered as a cost, but not the family's consumption.

Other values generated such as carbon stored in soil or property value appreciation due to good management were not estimated. Costs related to greenhouse gases emissions and property depreciation were not calculated. Table 6 provides an approximation of inputs and outputs used at Ridgedale.

*5.b. What are the main imports and exports of nutrients to/from the farm?*

The major exports from the farm are those embodied in the meat products and eggs sold. As the farm uses a compostable toilet, even the nutrients consumed in farm were recycled in the farm. The major imports were, as mentioned, the feed for chicken, food purchased off farm

(most of which remained in the farm due to the compostable toilet), timber and materials for construction and mineral nutrients for animal.

There is plenty of evenly distributed rainfall, so there is no need to irrigate the fields. Water for animals comes from the well or the stream, and for the vegetable patch comes from recycling greywater and from the well.

An energy balance for the farm was also not calculated.

*5.c. What is the profitability and cash flow of the enterprise like?*

Table 7 provides an estimate of the income, expenses and investments at Ridgedale. The most important sources of revenues are trainings (PDCs and internships), the sale of eggs and chickens. The biggest costs, investments aside, are the food for guest (PDC students, interns and core team) and chicken rations. The farm is lucrative in the three periods analyzed, but cash flow is negative in the first year (2014).

*6.a. How does the farm fit with the surrounding landscape and wildlife?*

The farm fits the landscape nicely with a balanced mix of pasture and forest. The keyline plantings of silvopasture trees give the landscape a flowing pattern, increase edge effects and microclimates and also the diversity of species.

Richard wants nature to thrive and wildlife is, in principle, welcome at the farm. Until now, amphibious, lizards, snakes and birds, including owls, hawks and eagles have not posed any problem.

More problematic animals (elk, deer, wolves) are excluded with permanent fences around the pastures. Richard concedes that such is possible due to Ridgedale's small size and abundance of forests around. If they had a 200ha they would consider creating passageways for wildlife.

They initially had some problems with the great number of voles nesting in the sward that became the silvopasture fields, but they were displaced through trapping and keyline plowing.

The streams are also important for biodiversity at the farm and carry brown trout.

*6.b. What do you clients and neighbors say about the farm and the farmer?*

Ridgedale unconventional operation is already influencing neighbors to think about creative ways of farming. For example, the owners of the dairy production in the village are thinking about converting to organic (as non-organic milk has low profitability and as Arla has relaxed the milk-purchasing rules, allowing farmers to sell a percentage of their milk off the farm gate) and looking at possibilities for organic cheese-making, asking Richard if he was interested.

*6.c. What do critics say about the farmer's approach? What is his answer?*

Richard is not aware of important criticism to his approach so far, though some people connected to the permaculture movement have criticized his use of vehicles and fuel. Richard views these as necessary to run even a permaculture-inspired farm that is productive and not reliant on cheap labor.

## Table 6 - Goods produced and consumed at Ridgedale Permaculture

| | Product/item | | 2014 | 2015 | 2016E | Assumptions / notes |
|---|---|---|---|---|---|---|
| Outputs | Eggs | Hens | 30 | 200 | 520 | Year-average number of hens |
| | | Production | 6,570 egg | 43,800 egg | 113,880 egg | 0.6 eggs/day *365 days |
| | | Sale | 3,285 egg | 39,420 egg | 102,492 egg | 90% of eggs; 50% first year |
| | | Consumption | 2,652 egg | 2,848 egg | 3,783 egg | 1egg/person-day |
| | Hens | Hens | 0 | 0 | 250 | Number of layers culled |
| | | Production | 0 Kg | 0 Kg | 250 Kg | 1Kg carcass weight (cw) |
| | | Sale | 0 Kg | 0 Kg | 0 Kg | 0% |
| | | Consumption | 0 Kg | 0 Kg | 250 Kg | 100% of culled layers |
| | Broilers | Broilers | 150 | 750 | 3,000 | 2.2Kg carcass weight;15% mortality |
| | | Production | 281 Kg | 1403 Kg | 5610 Kg | |
| | | Sale | 91 Kg | 1199 Kg | 5340 Kg | Non-consumed birds |
| | | Consumption | 189 Kg | 203 Kg | 270 Kg | 2 x 250g cw/person-week |
| | Vegetables | Area | 300 m2 | 500 m2 | 1050 m2 | 1 box/m2 in 2016, 0.5box/m2 in 2014 and 2015 |
| | | Production | 150 boxes | 250 boxes | 1,050 boxes | |
| | | Sale | 0 boxes | 0 boxes | 800 boxes | 40box*20wk to sell in 2016 |
| | | Consumption | 150 boxes | 250 boxes | 250 boxes | |
| | Milk | Milking cows | 1 | 1.2 | 0 | |
| | | Production | 2,880 L | 3,456 L | 0 L | 12L/cow/day * 240days |
| | | Consumption | 2,652 L | 2,848 L | 0 L | 1L/guest-day (inc yoghurt etc) |
| | Mutton | Lambs | 0 | 7 | 6 | |
| | | Production | 0 Kg | 140 Kg | 120 Kg | 20kg cw gain/lamb |
| | | Consumption | 0 Kg | 112 Kg | 101 Kg | Guest-days share of production |
| | Ducks | Ducks | | 14 | 0 | 2016 not known |
| | | Production | 0 Kg | 28 Kg | 0 Kg | 2kg cw gain/bird |
| | | Consumption | 0 Kg | 22 Kg | 0 Kg | Guest-days share of production |
| | Fruit and berries | Area | 0 m2 | 0 m2 | 0 m2 | Fruit tree and bramble areas |
| | | Production | 0 Kg | 0 Kg | 0 Kg | Current production still small |
| | | Consumption | 0 Kg | 0 Kg | 0 Kg | Guest-days share of production |
| | On-farm training | | 1552 p-day | 1648 p-day | 1383 p-day | |
| | Other training & consulting | | 28 days | 14 days | 14 days | PDCs of 13 days + consulting |
| | GHG storage | | | Not calculated | | |
| | Property appreciation | | | Not calculated | | Increase in value due to property improvement |
| | Other production | | | | | |

| | Item | 2014 | 2015 | 2016E | Assumptions / notes |
|---|---|---|---|---|---|
| Inputs | Pullets | 30 | 350 | 350 | Number of chicks bought |
| | Feed (layers) | 1,080 Kg | 7,200 Kg | 18,720 Kg | 36kg*average # of layers |
| | Grain (layers) | 195 Kg | 1,300 Kg | 3,380 Kg | 6.5kg*average # of layers |
| | Egg packages | 110 | 1,314 | 3,416 | 30 eggs/box |
| | Oyster Shells | Detailed information not available | | | |
| | Heating, straw | Detailed information not available | | | |
| | Fuel & energy | Detailed information not available | | | |
| | Other costs | Detailed information not available | | | |
| | Chicks | 150 | 750 | 3,000 | |
| | Feed (broilers) | 630 Kg | 3,150 Kg | 12,600 Kg | 60g/chicken/day for 70 days |
| | Grain (broilers) | 630 Kg | 3,150 Kg | 12,600 Kg | 60g/chicken/day for 70 days |
| | Other costs | Detailed information not available | | | |
| | Seeds | Detailed information not available | | | |
| | Amendments | Detailed information not available | | | |
| | Fuel costs | Detailed information not available | | | |
| | Other costs | Detailed information not available | | | |
| | Bedding | Detailed information not available | | | |
| | Hay | Detailed information not available | | | |
| | Minerals | Detailed information not available | | | |
| | Bedding | Detailed information not available | | | |
| | Hay & sillage | Detailed information not available | | | |
| | Minerals | Detailed information not available | | | |
| | Ducklings | Detailed information not available | | | |
| | Other costs | Detailed information not available | | | |
| | | | | | |
| | Maintenance | Detailed information not available | | | |
| | Harvest costs | Detailed information not available | | | |
| | Other costs | Detailed information not available | | | |
| | Food and tools | 1552 p-day | 1648 p-day | 1383 p-day | |
| | Building materials | Only cost is available, not quantity | | | |
| | GHG emissions | Not calculated | | | |
| | Property depreciation | Not calculated | | | Wearing of machinery, fences, buildings, etc... |
| | Other costs | Only cost is available, not quantity | | | |

| Notes | | | | | |
|---|---|---|---|---|---|
| | Guest-days | 2652 p-day | 2848 p-day | 3783 p-day | 200d*(coreteam) + interns + PDC students |
| | Guest share of consumption | 79% | 80% | 84% | |
| | Family-days | 700 p-day | 700 p-day | 700 p-day | 2 people, 350 days/year |
| | Family share of consumption | 21% | 20% | 16% | |
| | *Source for supermarket prices: https://www.coop.se/Handla-online/* | | | | |

*Fruits, timber, nursery trees, mushrooms, and food processing (jams, chutneys, ham curing) already produced in farm for domestic consumption. Some of these activities may be increased to a commercial scale in a recent future.*
*Both property appreciation and depreciation are difficult to calculate without apraisal of market values.*

**Table 7 - Income, costs and investments at Ridgedale Permaculture**

| | Product/item | | 2014 | 2015 | 2016E | Assumptions / notes |
|---|---|---|---|---|---|---|
| Income | Eggs | Sold | 9,855 SEK | 118,260 SEK | 307,476 SEK | 3.00 SEK/egg |
| | | Consumed | 6,365 SEK | 6,835 SEK | 9,079 SEK | 2.40 SEK/egg |
| | Hens | Sold | 0 SEK | 0 SEK | 0 SEK | 75% of broiler price |
| | | Consumed | 0 SEK | 0 SEK | 12,750 SEK | 75% of broiler price |
| | Broilers | Sold | 7,741 SEK | 101,921 SEK | 453,882 SEK | 85 SEK/Kg |
| | | Consumed | 12,881 SEK | 13,833 SEK | 18,375 SEK | 68 SEK/Kg |
| | Vegetables | Sold | 0 SEK | 0 SEK | 212,000 SEK | 265 SEK/box |
| | | Consumed | 31,800 SEK | 53,000 SEK | 53,000 SEK | 212 SEK/box |
| | Milk | Consumed | 30,233 SEK | 32,467 SEK | 0 SEK | 11.4 SEK/L [1] |
| | Mutton | Consumed | 0 SEK | 25,285 SEK | 22,784 SEK | 225 SEK/Kg [2] |
| | Ducks | Consumed | 0 SEK | 1,753 SEK | 0 SEK | 78 SEK/Kg [3] |
| | Fruit/berries | Consumed | 0 SEK | 0 SEK | 0 SEK | 35 SEK/Kg [4] |
| | On-farm training | | 729,440 SEK | 774,560 SEK | 650,010 SEK | 470 SEK/person-day |
| | Other training & consulting | | 112,000 SEK | 56,000 SEK | 56,000 SEK | 4,000 SEK/day |
| | Subsidies | | 112,000 SEK | 9,400 SEK | 9,400 SEK | Subsidies for fence in 2014 |
| | Property appreciation | | | Not calculated | | |
| | Carbon storage | | | Not calculated | | |
| | **Real income** | | **1,052,315 SEK** | **1,183,915 SEK** | **1,795,356 SEK** | |
| | Additional loans | | 0 SEK | 0 SEK | 0 SEK | |
| | **Total cash inflow** | | **971,036 SEK** | **1,060,141 SEK** | **1,688,768 SEK** | |

| | | | | | |
|---|---|---|---|---|---|
| Investment | Vehicles | 80,000 SEK | | 65,000 SEK | ATV Yamaha Rhino |
| | Machinery | 153,000 SEK | | | Tractor, plows, bedformer and power harrow, tools, hoses, building material |
| | Tools and material | 4,000 SEK | 10,000 SEK | 100,000 SEK | |
| | Eggmobile & broiler pens | | | | |
| | Buildings | 90,000 SEK | 100,000 SEK | | Slaughtery, greenhouse, yurts |
| | Tree planting | 127,900 SEK | | | Mostly trees and transport |
| | Other | 105,000 SEK | | | Fencing |
| | **Total investment** | **559,900 SEK** | **110,000 SEK** | **165,000 SEK** | Plus Values still missing |

| | Item | 2014 | 2015 | 2016E | Assumptions / notes |
|---|---|---|---|---|---|
| Costs | Pullets | 1,740 SEK | 20,300 SEK | 20,300 SEK | 58 SEK/pullet |
| | Feed (layers) | 9,720 SEK | 64,800 SEK | 168,480 SEK | 9.0 SEK/Kg |
| | Grain (layers) | 780 SEK | 5,200 SEK | 13,520 SEK | 4.0 SEK/Kg |
| | Other hen costs | 1,500 SEK | 10,000 SEK | 26,000 SEK | 50.00 SEK/hen |
| | Chicks | 750 SEK | 3,750 SEK | 15,000 SEK | 5 SEK/chick |
| | Feed (broilers) | 4,095 SEK | 20,475 SEK | 81,900 SEK | 6.5 SEK/Kg |
| | Grain (broilers) | 1,575 SEK | 7,875 SEK | 31,500 SEK | 2.5 SEK/Kg |
| | Seeds | 2,000 SEK | 4,000 SEK | 10,000 SEK | |
| | Amendments | 2,000 SEK | 3,000 SEK | 20,000 SEK | Compost |
| | Bedding | 8,000 SEK | 18,000 SEK | 18,000 SEK | Winter bedding/feeding for cows and sheep |
| | Hay | 5,000 SEK | 10,000 SEK | 10,000 SEK | |
| | Minerals | 600 SEK | 1,000 SEK | 1,500 SEK | |
| | Fuel | 38,000 SEK | 38,000 SEK | 38,000 SEK | |
| | Electricity | 10,000 SEK | 13,000 SEK | 13,000 SEK | |
| | Employees | 0 SEK | 0 SEK | 250,000 SEK | |
| | Machinery rented | 4,000 SEK | 3,000 SEK | 18,000 SEK | |
| | Maintenance | 18,000 SEK | 18,000 SEK | 18,000 SEK | |
| | Other costs | 300,000 SEK | 100,000 SEK | 100,000 SEK | Cows, material |
| | Food purchased | 151,164 SEK | 162,336 SEK | 215,631 SEK | 57 SEK/person-day |
| | Production consumed | 81,279 SEK | 133,174 SEK | 115,988 SEK | |
| | Depreciation | 35,000 SEK | 50,000 SEK | 60,000 SEK | |
| | Other costs | 14,000 SEK | 14,000 SEK | 14,000 SEK | Debt servicing |
| | Taxes | 35,000 SEK | 45,000 SEK | 50,000 SEK | |
| | GHG emissions | | Not calculated | | |
| | **Real Costs** | **724,203 SEK** | **744,910 SEK** | **1,308,819 SEK** | |
| | **Total cash outflow** | **1,202,824 SEK** | **721,736 SEK** | **1,357,831 SEK** | |

| | | | | |
|---|---|---|---|---|
| **Real Net income** | **328,112 SEK** | **439,005 SEK** | **486,537 SEK** | |
| **Net cash flow** | **-231,788 SEK** | **338,405 SEK** | **330,937 SEK** | |

| Notes | | | | |
|---|---|---|---|---|
| Value of goods consumed = | 80% | of the price considered for goods sold. Lower price was assumed as some of the consumed goods are lower grade and don't require transport | | |
| [1] Organic milk price in supermarket | [2] Mutton price in supermarket +25% | [3] Organic chicken in supermarket | [4] Prices vary. Some fruit is cheaper, other more | |
| *Source for supermarket prices: https://www.coop.se/Handla-online/* | | | | |

### 7. What are the farmer's views on agriculture, food and society?

In one hand, Richard is hopeful as he thinks it has never been a better time for people, especially inexperienced people, to come into agriculture, as the skill set required is different – some of the most successful entrepreneur types did not follow stereotypical farmer career paths.

Even in the midst of conventional Big Ag, there are many windows of opportunity for small farmers. Especially in western countries, the demand for non-chemical, good husbandry, quality products is growing massively. Currently there is not much competition in this segment, but there will probably (and hopefully) be in the future. This is not seen as a threat but as a pressure that will drive innovation and help to refine models and adapt them better to local context.

On the other hand, Big Ag keeps buying land, getting bigger, more intensive, and that has several ramifications, in loss of biodiversity and soil, for example. The amount of work people in his field can do is marginal compared with Big Ag, and while it can grow hugely, it is still off most people's radar. People concerned with regenerative agriculture can be so focused on their work and like-minded people that they may overlook that most people have no clue about what they are doing.

Richard thinks that alternative agriculture will only influence Big Ag when it is able to strike a solid balance between profitability and consumer engagement. Many farmers are not trained on the ecological component of farming, so that is not high in their agendas and they are driven more by financial and social pressures in their decision making (conscious or unconscious).

Therefore, while being optimistic regarding the possibilities, Richard is aware of the scale of the challenges faced.

### 8. What other information is worth noticing?

*8.a. What distinguishes the approach from others, particularly those that inspired it in the first place?*

Though Joel Salatin is a big influence, several of his approaches aren't immediately applicable to Ridgedale's social and economic context. One clear difference relates to scale. Ridgedale is 10x smaller than Polyface and not so suitable to raise large herbivores for sale.

Joel also put in an enormous effort to create a network of engaged and educating customers. This should be easier to do at Ridgedale, as the size and number of customers is also smaller. Furthermore, pioneering some of his ideas in Sweden will hopefully make it easier for the next person in Sweden doing something similar.

# 4.COMPARATIVE ANALYSES OF THE FARMS COVERED

## PROMOTION OF DESIRABLE OUTCOMES

As already stressed in the introduction, any answer to this question is context-dependent, not only regarding the circumstances of time and place, but also of the values and aspirations of who's answering. Here we are answering it from a point of view that values the protection of wildlife and biodiversity, animal welfare, good working conditions, food quality and safety, but also recognizes that without good levels of productivity, profitability and affordability the former goals are likely to be undermined.

### Quantity of food production

It would be unfair to compare the three farms in terms of food production as they are at different stages of maturity – Polyface is being developed for 50 years, while NFF has barely 20 years and Ridgedale has only 2 years of operation. Moreover, NFF and Ridgedale involve an important tree crop component which takes longer to mature.

#### Polyface Farm

The data available for Polyface does not provide a complete picture of its production – though the number of customers is mentioned, there is no indication about how much each buys and how much is used for self-consumption.

#### New Forest Farm

Mark's estimate of edible calories produced by a typical NFF 1-acre block at maturity (system 1 in Table 8) double those produced by 1 acre of corn (system 7 in Table 8).

**Table 8 - Comparison of edible calorie output of NFF and other farming systems**

| | Production system | Calories of edible human food | % of Mark's value for NFF | Main assumptions |
|---|---|---|---|---|
| 1 | NFF (Mark's assumptions) | 5,977,720 Kcal | 100% | Base scenario; Farm accounts for 100% of pig and chicken feed; only 1 day of milk production considered |
| 2 | NFF (Mark's assump.+200d of milk) | 8,764,635 Kcal | 147% | Same as above but adjusted for 200 days of milk production |
| 3 | NFF (Lower yields) | 4,054,785 Kcal | 68% | 50% less nut & apple yields; lower animal stocking rates; farm accounts for 25% of chicken and pig feed |
| 4 | NFF (Lower yields +200d of milk) | 5,448,242 Kcal | 91% | Same as above + 200 days of milking |
| 5 | Average of NFF in monoculture | 1,638,524 Kcal | 27% | Average of NFF crops (ex. honey and mushrooms) in monoculture; 20% feed for pigs & chickens |
| 6 | Best NFF crop in monoculture | 4,230,000 Kcal | 71% | Apples at 18,000lb/ac and 235Kcal/lb |
| 7 | Corn 150bu/ac (Mark's assump.) | 3,060,000 Kcal | 51% | Weight of feed to meat conversion = 5.4%<br>All grain exportad for food<br>Distillers' grains conversion to food of 0.27% |
| 8 | Corn 200bu/ac (Mark's assump.) | 4,080,000 Kcal | 68% | |
| 9 | Corn 150bu/ac (revised assump.) | 3,773,530 Kcal | 63% | Feed to meat conversion = 10%<br>80% grain exportad for food<br>Distillers' grains conversion to food of 2.9%<br>Calorie distribution mirrors US corn use |
| 10 | Corn 200bu/ac (revised assump.) | 5,031,373 Kcal | 84% | |

**These assumptions do not consider either corn's use as biofuel or NFFs biomass production, which could also be used for energy generation.**

Though there are inconsistencies not yet clarified[†], even more pessimistic assumptions, such as system 7 (which considers lower yields and stocking rates, but adjusts milk production) compares favorably with system 10 (which considers corn's edible calories at a 200bu/ac, which is above average US yield, and higher feed to meat conversion).

If these values are indeed achievable, they would represent an invaluable contribution to increase food supplies. However, some additional consideration may be needed:

- Mark's assumptions imply that all nut calories from carbohydrates and oil would be used for human consumption. However, it is reasonable to expect that some would also be fed to animals, thus having a lower conversion of feed-to-human calories;
- Other NFF blocks have different assemblies, which may have different calorie outputs;
- A transition to the system involves years of low production, in establishment and development of locally-adapted specimens. These effect needs to be diluted over the longevity that plant, thus lowering average production.

This does not mean that models similar to Mark's cannot be important contributors to humanity's food supply. However, a clearer assessment of its production potential needs to consider the actual production of the entire farm at different periods of time, even if one allows that there is much to learn about these systems and that they would have potential to increase productivity in time.

#### Ridgedale

Ridgedale's production in 2015 represents:

- much of the meat, vegetables and dairy to feed ~10 people during a year[‡];
- the yearly chicken consumption of 142 swedes[§];
- the yearly egg consumption of 477 swedes[**].

A comparison with similar farms was not performed, as it would require analyzing the area necessary grow the grain and feed for chicken and the hay for the cows during the winter, and data on the area and production of farms in Sweden or similar climates.

### Quality of food produced

Both producers comply with local regulations and the absence of toxic products, hormones and sick animals is a good indicator of product safety. No analyses were done that allow to unequivocally state that Ridgedale's (or Polyface's or NFF's) food is

[†] Namely the low amount of calories considered for milk production. Mark was contacted via email on 08/04/2016 and replied, but as of 15/05/2016 has not yet clarified the questions.

[‡] Approximately 3500 person-days

[§] 2100kg of chicken at average yearly consumption of 14.8Kg[102],

[**] 94,000 eggs at an average yearly consumption of 197 eggs[103].

safer than other farms'. It is, however, more transparent than most in this regard – customers can visit the farm and see how the products are raised and processed.

Nutritional qualities, taste and 'cleanliness' are one of Joel's (and Richard's) key selling points. Studies have shown that pastured chickens' eggs' nutritional profile does differ significantly from those of caged ones[104]. Moreover, these studies are often conducted in simplified trials that fall short of the actual practice of the authors, so it is possible that the discrepancies are even higher. Similarly, it has been shown that grass-finished red meat has nutritional advantages over grain-finished meat[105].

Meat flavor differs between animals fed grass and grain. Customer preference is not consistent with the type of feed as it varies with cultural habits[106–108] (and probably also in time within the same culture). Therefore, it is expected that several customers used to meat from grain-fed animals will be less receptive to meat from grass-fed animals.

On a personal note, the author of this study can vouch for the taste of the products at Ridgedale, where he tasted some of the best chicken and duck of his life.

## Farmer fulfillment

### Purpose and lifestyle

All three farmers are proud of their work, not only for the quality of their production, but also for its transformative potential in their farm and elsewhere. This sense of purpose is strengthened by the appreciation and support of their customers and communities, particularly in case of Joel Salatin.

Both farmers enjoy the lifestyle and challenges that come with their work. The winter downtime provided by the seasonality of their approaches is considered valuable as it allows for rest, reflection, and time to devote to family and other activities. They enjoy the complexity and constant experimentation, observation and finetuning that their diverse systems entail. All farms are lively, with several people staying or working (apprentices, partners, students) for longer periods and customers and visitors coming for shorter periods. The frequent travels for conferences, speeches and consultations, add further diversity to the farmers' lifestyle. All farmers value their farms as more than sources of work and income. They often refer its aesthetical and spiritual values and how they provide a healthy and pleasant place to live and raise their families.

While it is not a stretch to say that most farmers would appreciate such surroundings, it is more uncertain that all would enjoy the constant learning attitude and broad skills that these models demand. Maslow's hierarchy of needs considers self-actualization as the 'highest' human needs[109], but it is possible that many farmers may prefer a more a more specialized or direct approach, with simpler routines and work plans devised by someone else. On a further reflection, however, it is unclear what the role in value creation of such farmers is. It can be expected farming jobs will continue to be replaced by automation, just as many factory workers have been replaced by robots[5].

On the other hand, for many farmers to follow such seasonal production cycles, a shift in consumer patterns would be required (this issue will be explored in a later chapter).

### Income

The authors share their strategies for profitability but little details of their income. Although both argue for local/regional processing, and 'stacking' enterprises (creating different sources of cash-flow from the farm), they differ in their emphasis.

#### *Joel Salatin / Polyface Farm*

Joel argues that profitable niches are growing and client relationship is key to sell at premium retail price. He also stresses that low cost approaches are necessary not only in farming – where the profitability of every venture and acquisition must be analyzed – but also in the farmer's personal life, where thrift is essential until the farm is solidly profitable.

Looking just at chickens, Joel's claim that is possible to net possible to net ~19$/hour (25,000$ in 6 months from 20 acres, working 50 hours per week)[14] is slightly above the most optimistic research based on US producers: one model gives an hourly return of 10-18$ USD/hour (depending on the number of birds and farmer skill)[110] while another experiment reveals a break-even point $5.20/lb (carcass weight), considering labor at 15$/hr.[111]. Only 50% of Californian pastured poultry producers report direct profits, but 28% more report indirect profits form interaction with other enterprises[112].

These studies show that profits of pastured poultry by itself are possible, though not achievable by everyone. However, they also indicate that pastured poultry works better when coupled with synergistic enterprises, as the authors propose.

#### *Mark Shepard / New Forest Farm*

Mark is less optimistic than Joel, as he sees the current system as inherently unprofitable for most farmers. Therefore it is critical to lower expenses and develop cooperation and regional processors to increase production value.

His example that a perennial crop can be more profitable than an annual monoculture assumes retail prices for chestnuts and bulk prices for corn (Table 9). However most growers sell through stores at about half of the price Mark considers[113]. He also considers yields close to dedicated growers, and does not take in account the early (3-12) years when chestnuts produce below peak levels[113].

**Table 9 - Profitability comparison of corn and chestnuts**

| | **Corn** Mark's assumptions | **Corn** 200bu/ac | **Chestnuts** Mark's assumptions | **Chestnuts** lower yield & price |
|---|---|---|---|---|
| Yield | 150 bu/ac | 200 bu/ac | 1,000 lb/ac | 500 lb/ac |
| Price | 8 $/bu | 8 $/bu | 5.00 $/lb | 2.50 $/lb |
| Revenues | 1,200 $/ac | 1,600 $/ac | 5,000 $/ac | 1,250 $/ac |
| Costs | 250 $/ac | 250 $/ac | 83 $/ac | 83 $/ac |
| **Profit** | **950 $/ac** | **1,350 $/ac** | **4,917 $/ac** | **1,167 $/ac** |

This is a simplified example – chestnuts are only one of the crops in the proposed polycultures, and the costs considered (83$/ac) include expense with annuals. Moreover, even if bulk prices and lower yields are assumed for chestnuts, its

profitability still compares favorably with an average corn grower. Though Mark's argument may well be true, a more adequate analysis of the assumptions is needed.

*Richard Perkins / Ridgedale Permaculture*

The estimations for Ridgedale (Table 7) attempt to capture not only the costs and profits from sales, but also from the production that is consumed at the farm – otherwise, the numbers would understate the magnitude of production and consumption at the farm. Though more detailed data would be desirable, these estimates indicate that the farm is providing and income of 300,000 – 500,000 SEK. While this value is clearly below the average income of two people in Sweden, it already includes housing, food, 'commuting', telecommunications and other normal expense. The cash-flow, however, is lower and negative in the first year due to many investments (also, the value for acquisition of the farm is not included).

In general these reports are in line with findings that, even in less integrated and diverse systems, reducing input costs can more than compensate for moderate drops in production[114–117]

These numbers also show the complexity of calculating the income of multifunctional and diversified farming systems, and demand some caution not to draw hastened conclusions. For example, it is not clear what share of Joel and Mark's income comes from non-production activities (training, consulting, speaking, etc…). These have been an important source of revenue in Ridgedale's early years and without it, development would have had to proceed at a slower pace or with other sources of financing.

### Promotion of wildlife and biodiversity

It is argued that quality of agricultural landscape matrix is important for many species[118]. Neither of these farmers uses biocides and it has been shown that organic systems surpass conventional ones in terms of biodiversity[119,120]. Though these farms differ in their size, features and surroundings, they all include interaction of pasture, forest, and water features. These creates a high landscape complexity which is an important driver of biodiversity[121]. The fact that they tolerate minor losses in production is also likely to favor wildlife.

Though production is based mostly on conventional hybrid breeds, re-integrating animals back into agriculture benefits important wild biodiversity[73]. By keeping some heritage breeds and breeding for locally adapted traits (e.g., Joel's breeding of rabbits suited to pasture and Mark and Richard's experiments with trees), these approaches have the potential to generate varieties that increase genetic diversity.

Managing such high agrobiodiversity would surely be challenging for most farmers, as it requires a much wide knowledge of different plants and animals. Whether the potential synergies between multiple species would compensate the lower knowledge and attention to individual species is difficult to assess without more in-depth studies.

### Animal welfare

The authors claim their approaches provide superior animal  as animals are able to express natural behaviors (such as grazing, scratching and rooting) because they are kept in relatively small flocks/herds (even Joel Salatin's, which has the largest of the three, are small when compared to confined operations[122]), outdoors in fresh pasture and provided good nutrition, shelter and space.

This view involves a balanced approach of the three different conceptions of animal welfare: the focus on the affective states of animals; on the ability of animals to lead natural lives; and on basic health and functioning[123]. The underlying assumption is that animals living reasonably natural lives will be healthier and happier.

Though this assumption is not necessarily wrong, it should be cautioned that are often trade-offs among these conceptions – e.g., alternative poultry systems typically have higher mortality rates than confined systems[124], for inexperienced farmers[125]. Unfortunately, no data was collected on the animals' health and mortality rates, and more research is needed to understand these farmers' efforts provide good animal welfare under the three concepts.

### Sovereignty and social cohesion

All three authors defend local/regional food systems of small/mid-sized players, on the basis that these tend to be more transparent, democratic and prosperous for the community. In this respect, the authors do not appear to fall in the 'local trap' that Born & Purcell caution against[32], as they view 'local' and 'small scale' as means to ends.

However, this drive for locality may in some cases conflict with other potential objectives: farmers may become more dependent on their neighbors, thereby amplifying potential negative events. On the other hand, these farmers are also more able to influence their communities and improve adverse situations.

### Working conditions

The farmers studied have different perspectives on labor. Mark is critical of employer-employee relationships and prefer to establish business partnerships with "interns". On the other hand, Joel and Richard employ people and also have interns/apprentices.

Low salaries and poor working conditions are one of the weakest and less studied features of organic agriculture[126], and it could seem that by having interns/apprentices, these farms rely on cheap labor to thrive.

Though apprentices may clearly expand the possibilities of what these farmers can do, continuous applications and good relationships with ex-volunteers and ex-employees indicate satisfaction with the working and learning experience.

Indeed, research indicates that the diversity of task is the best explanation why organic farmer workers are happier than those employed on conventional farms[127]. Also, all-

organic farms with diversified cropping patterns and direct sales tend to provide above-average wages and benefits."[128]

More rigorous surveys would be required to better understand the working conditions and the satisfaction of workers and volunteers at highly diversified farms, and also the magnitude of their impact in the farms' bottom line. It would also help to understand what are the skills and mindset necessary for a farmer to be able to attract and provide a good experience for interns or apprentices.

## MAINTENANCE OF MAIN CHARACTERISTICS OVER TIME

### Maintenance and re-generation of critical resources

The three authors are generally similar in their approaches, but some differences exist.

#### Soil, water and nutrients

Both authors consider pasture quality as their critical biophysical resource and use similar leader-follower rotational grazing systems to achieve that goal. The differences are more visible in design and management of water and tree cover: Mark and Richard re-designed their farms according to topography to improve the water flow on the entire farm and they also use agroforestry while Joel avoids to have trees on pasture.

Both Joel and Richard report improvement in their pastures, and Mark reports that subsoiling has increased the rate of topsoil creation. The magnitude of improvement reported by Joel is much bigger, which is likely due to the longer period of time he worked at it. Though no soil surveys are presented to back up these claims, they are in line with expectations that integrated crop-livestock systems enhance soil fertility, tilth and carbon sequestration[114]. While detailed analysis would provide more information, the scientific understanding of how soil and organic matter work is still evolving[129], and hence the improving plant production and health is good, though not fail-proof indication that soil conditions are also improving.

The lack of detailed values of inputs and outputs from the farm makes it difficult to understand the balance of nutrients. Both Joel and Richard are clear that they views the purchase of chicken feed as a fertilizer input – one that provides additional profits.

A more detailed analysis of nutrient cycles would help to monitor the evolution of different nutrients on the farm and clarify if improvements comes at the expense of sustainability in other places. The focus on crop-livestock interactions, perennials and agroforestry tends to benefit future fertility[130,131], but an integrated view needs to look at the practices of the suppliers and consumers. The fact that they are mostly regional may help, but it is not sufficient.

### Energy

All three authors harvest wood for energy. They differ, however in the proportion that forests. This is lower at Ridgedale and higher at Polyface, whereas for NFF is not 'purely' forest but a combination of different agroforestry practices.

All authors seeks to maintain energy consumption to a minimum, but Mark is the only one who produces on-site all the energy the farm requires.

### Genetic diversity

Although no measures of agrobiodiversity were calculated, the farms appear to be highly diverse on account of the different number of species and races/varieties used.

All authors use hybrid breeds in their main commercial: Joel and Richard in poultry and Mark in different trees. However, both Mark and Richard also keep heritage animal races and are active developing new tree varieties.

### Customer and community support

Richard and especially Joel spend much effort in communicating and involving their customers, whose trust is an important asset. For Mark Shepard, the involvement in processing and selling cooperatives is the most important way to market his products.

Joel has been able to maintain a base of enthusiastic customers over the decades. Mark has likewise benefited from the work of cooperatives to process and distribute his products. Though these require flexibility and constant effort, it is something over which the farmers have influence.

### Human resources

Experience, skills and knowledge, are probably the most critical elements for all of these farmers' success. All of them were raised in close contact with alternative and inventive famers. All of them are familiar with different approaches and travel the world in consulting and speaking engagements that put them in contact with different strategies. Both Joel and Richard careful experiment, record and review farm work fine-tune their approaches. Mark does not mention such meticulous recording, and relies on mass selection and constant observation of results to obtain the best plants.

All three farms benefit from the interest of apprentices and interns that help to run the farm at a low financial cost (though at an expense of time and potential increase in mistakes). Though apprenticeships are not without problems if poorly designed[132], they can be an important contribution to revitalize networks of small farms[132,133] and develop the skills and knowledge necessary for tomorrow's alternative farms.

However, it can be challenging for many more farms to benefit from apprenticeships. On one hand, it would require a more interest from society or partnerships with education institutions. On the other hand, it would also be more demanding from farmers, requiring people skills and the ability to provide an interesting experience.

## Functional integrity, autonomy and resiliency

### Functional integrity

The farms analyzed represent cases of "dynamic-integrated agricultural production systems", with "multiple enterprises managed in a dynamic manner that interact in space and/or time and these interactions result in a synergistic resource transfer among enterprises"[134]. This type of strategy and management allow for increased capacity to adapt to different circunstances and maintain the viability of the entire system.

### Resilience

There are arguments that would lead to believe that these farms are resilient:

- They produce several products which spreads the risk of crop failure and market fluctuations[135];
- The low use of inputs reduce exposure to price volatility[135];
- Low debt approaches reduces leverage (more variable costs than fixed costs);
- Use of multipurpose equipment increases flexibility to change production;
- The wide skillset allows to deal with unexpected events and change production if necessary;
- The good relationship and trust of customers may allow some forgiveness;
- Good links with critical stakeholders (regulators in Ridgedale, processors in NFF, community and apprentices in Polyface);

Joel's career as a full-time farmer for 30+ years while improving the land and growing the operation attests to the resilience of his approach at Polyface Farm. No big upheaval or resilience-testing moment is mentioned, but the operation had to evolve over the years to cope with evolving customer preferences. NFF has been in business for ~20 years, though it was not profitable in some of them. The farm has shown much greater resilience to floods when compared to neighboring row crop farms. It is still early to pass judgment on Ridgedale's resiliency, as the farm is in its early years.

### Autonomy

All three farmers are embedded in their communities, and attempt to retain a high sovereignty over their business. They are not 'lock down' by heavy investments or penalizing contracts and having multiple of enterprises in the farm allows to shift the focus of resources according to the context[116,134].

Furthermore they maintain a degree of influence over the people on which their success depends, such as their suppliers, customers and workers. This means that they do not strive for total self-sufficiency, but for autonomy and an inter-dependence of equals.

## SUITABILITY FOR BROAD ADOPTION

An approach can be broadly adopted if it works in conditions that are prevalent in many (or large) regions or if it can be adapted to work in a wide range of conditions.

These conditions can be grouped in two major groups: biophysical conditions, which relate mainly to the climate, soils and biome; and socioeconomic conditions, that refer to the characteristics of the market and the technology and skills required.

### Adoption in different eco-regions and biophysical endowments

The production base of the approaches studied is based on different combinations and variations of intensive rotational grazing, pastured poultry and agroforestry. These techniques have been applied in various forms all over most of the globe[130,136–140]. The question is, how would the application of these proposals to other zones affect their productivity and profitability?

Mark's system should be viable anywhere it is possible to have different layers of nut and food bearing trees and bushes and pastures. As he notes, the options for climates colder than his present increased difficulties due to less species and shorter growing season and yield. Warmer climates, on the other hand, could be even more productive as there are more species and varieties to choose from. Water scarcity and poorer soils, though may become problematic and require additional costs (e.g., earthworks and irrigation) to address.

Joel's approach should at least be feasible in temperate regions were grasses grow well. While this should be easier in places with regular rainfall, it will be more challenging where rainfall is irregular.

Richard's approach sits somewhere between Mark's and Joel's. Agro-silvo-pasture should be possible not only in cool and temperate areas with regular rainfall, but have been practiced in Mediterranean in diverse ways[57], including in areas with more difficult access. Some changes, however would be needed: whereas Richard paints is Eggmobile black, to capture more heat, in warmer climates, ventilation and shade would be a concern. On the other hand, many productions would be feasible during a longer season, although water management would be more critical.

Other adaptations would be to substitute varieties for hardier species. But again, the question is how this would affect profitability? What combinations of animal and vegetal production would be best? Poultry systems exist everywhere, but if sourcing inputs from local/regional farmers, the system's productivity would also be dependent on the productivity of grains/legumes that compose a big part of their ration. An alternative would be to use species/varieties of poultry that are better foragers or provide more "marginal" areas to forage, but that could require more time, land or labor.

Therefore, the approaches analyzed appear to be feasible in a very wide array of conditions. They may require adaptations, however, and these matter in two regards: They may affect the overall productivity of the enterprise, either by yielding less or by requiring more resources of land or labor, particularly if local/regional source of inputs is to be maintained. This, in turn, may affect the profitability of the enterprise or reduce some of the benefits of the approaches presented (e.g., enough free time for farmer).

## Feasibility in different socioeconomic contexts

### Market penetration

These models benefit from a base of affluent consumers highly interested in healthy and ethical production. However, it is unclear how many more customers would accept paying higher prices or changing shopping habits to obtain a better product.

Though extending the share of total consumption will be challenging, there are also reasons for optimism. A raising poultry in an agroforestry context requires premiums of 54% over conventional production to be profitable[141] and in France, Label Rouge poultry (which are reared using traditional, free-range production methods and slower growing breeds) command 30% of sales despite costing double the price[124]. Convenience and shopping habits may pose a bigger hurdle than price.[142]. Mark Shepard's situation, where the farmer has a stake on regional processing and selling organizations can ease marketing challenges, but at the cost of lower margins, and perhaps a dilution of client-farmer relationship.

The situation in poorer countries has some similarities and differences. While there are many contexts and it is difficult to generalize, it is likely that few consumers would accept substantial premiums (although there may be a market for distinct/traditional taste). Those living in rural areas may be willing to travel to farms for a discount, but for the increasing number of urban dwellers, these systems would have to compete in cost with more conventional production and distribution.

### Technology

These systems are similar in which they avoid expensive technology. As such, they should be perfectly feasible to replicate in middle-income and rich countries where multipurpose tractors trailers, irrigation equipment electric netting and power tools and other supplies are widely available. Not everybody may have access to a cheap second-hand market – and an increase in farmers seeking second-hand equipment may increase its cost, though at the same time also encouraging new businesses of efficient and cheap tools. In poorer countries, not all tools may be so easily or cheaply available (e.g., electric netting, or tractors to move eggmobiles). Labor, however, should be much cheaper, and with basic resources it should be possible to build fences and sheds necessary. The impact of so much labor on profitability is uncertain, though.

#### Knowledge/skills

Diverse and dynamic approaches like the authors propose are complex and knowledge intensive, not only at the planning stage, but also in operating and adjusting[134]. All the authors have had involvement with alternative farming since their youth. Much of their accumulated knowledge that allows them to start (Mark, Richard) or expand (Joel) a complex farm business may simply be out of reach for most specialized or unexperienced farmers. On the other hand, there are much more resources and support networks easily accessible today. Joel, Richard and others also provide internships and apprenticeships that allow others to learn alongside them. These new approaches of farming business also require a different set of skills, namely marketing, organizing, planning, observing and experimenting).

People lacking this skills may just have to start smaller and grow slower, as errors can be costly. Chicken mortality rates in pastured poultry operations are much higher for inexperienced growers (10-30%) compared to experienced growers (~2%), as it takes about five years to learn properly learn how to do it.[125]

Poorer regions may lack the scientific knowledge easily available in rich countries, but may be better able to tap on tradition and knowledge of their.

#### Farmer autonomy or dependence in supporting institutions

The processing of any of these products – be it chickens, cows or chestnuts – requires labor, and above a certain scale is almost certain to require some form of machinery. In a small scale, however, it is possible to do most things with simple tools and family labor. Many of these products that can easily be direct marketed, given todays' communication technologies which makes these models well suited for pioneers even in the absence from the support of business and institutions around.

Regulations can be the biggest obstacle. The burden of complying with regulations is disproportionately heavy for smaller farmers. Joel and Richard have found low-cost ways to comply with regulations, but for some cases Joel and Mark had to enter cooperatives to be able to process their products profitably.

In poorer countries, both regulations and processing facilities may be lacking, at the same time helping and hindering this kind of enterprises.

## WORLDVIEWS AND NARRATIVES PROMOTED

### Rejection of the industrial model

Though with slightly different emphasis the three authors criticize the industrial model of agriculture on similar grounds: its impact on environment and biodiversity, the low productivity and energy dependence compared to diverse systems, the decline in nutrition, the degradation of farmer incomes and worker conditions, the cruelty towards animals and the impoverishment of rural communities. These criticisms are in line with many findings reported on scientific literature.[27,44]

The authors argue that 'industrial organic' approaches share many of the conventional model downsides, an argument that equally finds support in literature[126,143].

### Role of ethics and values

All authors are guided by values and principles that delimit the scope of their actions. In contrast to industrial agriculture, these go beyond productivism and profitability to include ecological, aesthetical, social and personal concerns. Mark's narrative explores, mostly from a rational point of view, how to achieve social goods, while Richard focus more on the farmer's context – not only the external resources and pressures, but the personal aspirations (e.g., of income, free time, main interests). Joel's arguments, in turn, are more embroidered in religious and emotional narratives.

Even if these narratives at times acknowledge the existence of competing values, and the challenges of acting in a less than ideal world, they focus mostly on the positive visions and possibilities. Although this is understandable, these competing values deserve deeper reflection, as decisions that are sensible today (e.g., leasing more land to meet expanding demand; concentrating economies of scale in processing and selling) can, without proper safeguards, lead to the same conventionalization that has affected organic agriculture[144].

Despite their limitations, these type of narratives may offer tools to think and talk about human intervention and the quality of agriculture. These are important because narratives influences both morality and practice – stories provide reasons, explanations and the idea of how things could or ought to be[145,146].

### Re-framing the productivity discussion

The authors place much importance in production efficiency, but they look at it from a different prism than conventional discourse and research. By internalizing a larger range outcomes (food produced, nutritional quality, land improvement, nutrient cycles, energy and resource conservation), these farms can help to better understand the full costs and benefits of food production over the long term.

In addition, they raise the issue that improved design and management in time and space allows for more and better production with less resources. However, the figures provided are not comprehensive enough to understand the production and productivity of the entire operation.

### Farm profitability

Profitability and farmer income is also one of the main elements in these authors' narratives. As already noted, they argue that, even though the current system is set out to favor large businesses[147], good strategies (choice of niche, value adding, direct selling), efficient approaches and marketing savvy allow the small farmer to run a profitable and fulfilling operation. Though they warn about difficulties and pitfalls,

these ideas are mostly framed in positive narratives that value personal initiative and 'can-do' attitude.

The authors are confident that an increasing number of farmers following in their footsteps will bring more advantages (increasing awareness and market size, better suppliers, refinement of models) than disadvantages (market saturation and price decline). Ultimately, it is not possible to know how society, governments and other producers will react, so while future profitability is possible, it is far from assured.

### Need for social change

Mark and especially Joel write about the need for society to change habits if a sustainable (or 'sane') society is to emerge. While Mark's suggestion that more regional cooperatives and processors are needed may be feasible, his call to changing tastes to adapt to perennials (e.g., chestnut flour, hazelnut oil) may face bigger obstacles. Joel, on the other hand, views regulation as the main obstacle to rural entrepreneurship and regional processors. It may be possible that more regulatory concessions to small scale processors would allow more of these companies to flourish, but it is unknown what will be the consumer backlash when, inevitably, one of these units will have some sanitary problem.

Similarly, the average consumers' lack of touch with cooking and the realities of food production is not likely to be reversed overnight. Nor will Joel's calls for more season-adjusted consumption, even if he shows them in a positive light, highlighting the increased taste and variation throughout the year. While these changes are not likely to come anytime soon, they may convince some people, and thus create a small base of aware consumers which can help to spread these ideas.

### Contributions to 'feed the world'

The authors also contribute to the heated debate about whether the conventional paradigm is essential to 'feed' a growing population. They share the view that waste, feeding grains to ruminants and inefficient design and management all need to be tackled before arguing that more land is needed.

Mark argues agroforestry practices need to provide at least as much calories, proteins and oils as conventional agriculture. Joel takes a different approach: while still sure of the efficiency of his methods compared to conventional production, he stresses the duty of farms to feed their communities rather than committing to overproduction that will destabilize and undermine the capacities of farmers in distant countries, which is in line with the idea of regional foodsheds[11].

### The empowerment of local communities

Both approaches advocate for more local or regional food systems, not only in production, but also in transformation – on a farm as Joel's and Richard's, or in regional cooperatives in the case of Mark and Joel.

This message of "keeping the dollars in the community" is certainly appealing in a world where many fear that globalization has gone too far. The authors do not advocate full self-sufficiency or an end to inter-regional trade (it would be doubtful that these message would resonate with large segments of the population)

Both Joel and Richard prefer to place their fate in local communities and consumers than in distant shoppers and anonymous value chains. While Mark shares this view, he regards that cooperatives have an important role to play in processing and distributing.

### Views on science

All the authors borrow from ecology in their arguments and call for experimentation in the farm and observation of results .They view scientific research in different ways. Mark argues in a mostly rationalized that skewed assumptions obscure the fact that monocultures of annuals are not as productive as polycultures of perennials. Joel is more suspicious of the agenda of most scientific establishment, and therefore relies on the researchers whose values are similar to his own.

Though this position can look like a way to escape findings that contradict a narrative, there is literature that supports the idea that science is indeed shaped by narratives and therefore, even with rigorous study, different interpretations can arise from the same phenomena[145].

### Appeal to different ideologies

Though the authors appear to write with aspiring farmer and the environmentally concerned citizen in mind, their narratives have elements that can appeal to different ideologies and social groups. They argue for both individual initiative and cooperation, for business approaches and ethical approaches, for entrepreneurship and for non-market concerns, for productivity but also ecological quality.

In particular, in an age and culture that worships business and entrepreneurs, these farmers provide a success story – beginning businesses from scratch or expanding the legacy of their fathers, all without much or any government support. Joel has even been featured in Business Week[78] and Bloomberg[82], among other magazines. These characteristics may provide a bridge with more conventional business thinking that may view alternative ways of farming as romantic but unworkable ideas.

However, there is some evidence that this approach risks inviting criticism from those most attached to a particular position.

### A vision that integrates environmental stewardship and human aspirations

The authors analyzed are adamant in rejecting ways of farming that exploit and degrade the land. They work to leave behind a better place, even knowing that the full benefits will only be reaped in decades, particularly Mark's and Richard's agroforestry systems that will take decades to mature. However, they all stress the importance of the

productive dimension of farming and thus they do not reinforce a dichotomy of "nature" vs. "culture", but the possibility of mutually beneficial interactions.

While it is obvious that such narrative has limits, it provides a vision of a better future that can justify thinking and working a little harder today instead of going down the easy road of conventional wisdom. At the same time, it is not a vision entirely made of sacrifices (which would be unacceptable to most people.

### Compatibility with both religious and secular beliefs

Joel's discourse is assumedly religious – he sees his work as a ministry of god's creation and he is not ashamed to preach it. While this may cause discomfort to those less religiously inclined, it does not have to be so. Mark and Richard's approaches share many of the same principles, values and techniques, yet their love and admiration for nature is expressed in a much more secular way.

This shows these approaches do not offend religious interpretations: they show ways of productive farming that do not imply sinning against God's Creation (if only we know how to discipline ourselves). But although these approaches demand some love and awe of nature, the religious interpretation is not a requirement. In harmonizing these two views, these approaches provide a discourse that can bridge the religious-secular divide that generates clashes in so many issues (e.g., abortion, gay rights, stem cell research, etc...).

# 5. DISCUSSION

### What new things do this authors and this thesis bring?

#### A different way to measure productivity

The multiplicity of productions makes it difficult to retrieve the necessary data and compare the productivity of diverse, multi-purpose farms to single purpose ones. Indeed, few studies provide data for diverse farms and instead approach productivity as the amount of a specific crop that is obtained for a set amount of land, capital, labor or energy[8,42,44,148].

One way to improve this comparison would be to use something akin to a Land Area Equivalent: to take the output in terms of nutrients, a basket of goods produced by a diverse farm or group of farms and compare it with the resources necessary to produce them in conventional agriculture. A decision would have to be made regarding the inputs to consider. Because agriculture is the largest user of land and water and an important source of greenhouse gases, these would be good candidates. Capital and labor, the typical denominators used in economics, are less adequate, as the comparing commodity producers to farmers that direct sell would have to take in account the additional people and resources involved in processing and distribution. Moreover, with large numbers of people are unemployed, underemployed or at risk of future

unemployment[5] and low interest rates in many countries it is hard to argue that those are the scarcest resources.

A rigorous analysis would also have to account for the resources required for the production of inputs in a coherent fashion (e.g., a diversified system should obtain inputs from a diversified farm, at least organic rotations). This would still miss other elements such as land improvement and environmental benefits, but at least it would be a better approximation.

The data collected is insufficient to make such analyses. Mark Shepard presents this type of comparison, but in a very simplified format. Some studies are being conducted on this topic[149], but published information is scare. However, these are crucial to understand what type of farms are actually more productive in which context. If studies only analyze similar farms, how do we know that we are not missing an opportunity to have a more productive system with less drawbacks?

### A rethinking of the organic-conventional dichotomy

Much research has focused on comparing organic and conventional agriculture as if these were polar opposites. In truth, may organic agriculture farms may be closer to the conventional model than to highly multifunctional and diversified farms[9]. It is therefore important that research begins comparing conventional farms not only to organic agriculture, but also to multifunctional and diversified farms.

### New avenues for participant research and innovation in farming

Many studies that try to establish the productivity or profitability of different farming systems prioritize large samples of common and homogeneous farms over alternative farms with many variables. This may be due to the perception that randomized control trials are the gold standard of scientific research, to researchers' uneasiness to deal with subjectivity and philosophy[150], or due to the challenges of such studies[114]

However, that may lead agronomists and agroecologists to miss discoveries that are not contemplated *a priori*. Detailed case studies can help to uncover new ideas, as researchers would see things that they didn't necessarily plan for.[151] The cases of successful and inventive farmers are particularly promising. Not totally unlike evolution, these have gone through periods of adaptation an refinement that culminated in models that likely work well, at least in their specific context.

Such research may still be amenable to generalization and has the advantage of showing what actually happens once the human factor comes into play. This can work even better if complemented with cases of failure are also detailed.

### A bottom-up avenue to change farming based on psychology

It is tempting to think that if problems are identified, clever solutions designed and smooth transition paths clearly laid out, change will follow. However, change is often harder and 'messier'. Without understanding the psychological basis of individual and

social action[152] meaningful change is likely to falter when faced with the quirks in human thought[153] and powerful entrenched interests. As with climate change, the discussion about change in food systems needs to avoid pitfalls that lead to misinformation and inaction. For this, it needs to[152]:

- Shift argument from the impacts in distant lands or distant to what can be done today and how it influences things 'right here';
- Discussion must shift focus from the downsides of a bad course of action to the upsides of a better course of action;
- Create opportunities for frequent action to reinforce behavior and avoid cognitive dissonance;
- Center in positive emotions rather than fear and guilt, which people prefer to ignore;
- Develop arguments that are independent of existing political polarizations.

Although they often spend time lamenting the harms of industrial agribusiness and society's lack of touch with agriculture, the approaches and narratives of the farmers studied fit remarkably well with these proposals and are therefore powerful tools to communicate change processes.

#### Approaches feasible all over the world without costly requirements

Much, if not most research on food systems focuses either on poor countries or industrialized countries, as the social conditions and economic means are deemed too different for comparison. The approaches studied here have a potential to bridge that gap, as they span different biome types and rely on generally simple methods that may be possible in poor countries as well.

The fact that they work in both poorer and richer countries is important, as the latter tend to export their models or be emulated by the former.

### A contribution as role models for change

Although current farming population is old, these farmers will sooner or later be replaced by younger ones. In the absence of concrete alternatives, these are likely to subscribe to the dominant values and examples available: industrial agriculture and the factory-farm.

The farmers studied can provide role-models for a new generation of farmers, which are more likely to try new things than old ones[55]. Also, peers and concrete examples may stand a better chance of convincing existing farmers to change their ways, than more hierarchical ways of communicating.

While context specificity could hinder adoption by others, it may also help to clear others' own context. Averages may miss vital information for many decisions: what is the "average life objectives"? what is the "average business strategy"? Knowing the specific details of a case helps to understand where it is similar and where it differs from one's own case.

### Compatibility with the current system

The farmers analyzed conduct their business within the current social structure, which allows consumers and other producers to change their ways in a fairly gradual manner. This is important, as it provides concrete examples of alternative systems in action that can resonate with farmers, consumers and policy-makers and steadily draw them away from the industrial paradigm.

### Potential consequences/requirements of widespread adoption

#### Seasonal, local and flexible of food systems

Limitations to widespread adoption may come more from cultural rather than technical obstacles. These models would require people to accept a more local and seasonal consumption, as currently consumption patterns depends, to a great extent, of controlled climate facilities, or long distance trade. In addition, if Mark Shepard's view would be realized, it would also involve shifting tastes from annuals to perennials. Given that, as mention by Joel Salatin, most people can only take so many changes, either this process is very gradual or it will need additional incentives.

A change to more direct selling would require consumers to be more flexible and perhaps less demanding of convenience. Processors and retailers would also need to be more flexible. Currently used to standardized products from a few suppliers, they would have to manage more complex supply chains.

#### Demand and price

Although potential market is very large, it is unlikely that market penetration above a certain point is compatible with high premiums. The alternative would be for food prices to rise to account for the true cost of production – a simulation for pastured poultry in an UK agroforestry system remains profitable with a premium of 54% above the conventional market rates[141]. Such prices might require additional measures to make sure that the poorest members of society would not be affected.

#### Availability of knowledgeable farmers

Though physical and economic factors may be managed, the farmers analyzed reveal extensive experience with organic farming, which may not available to many aspiring farmers. Through their models of apprenticeships and internships these farmers are helping to educate the farmers of tomorrow, which may contribute to fulfill this requirement. Additionally, partnerships with universities and vocational colleges may allow this model of education to expand beyond their current situation – although that would require more farmers to be receptive and prepared to provide such experiences[132].

### Considerations on study quality and limitations

#### Study limitations

In this thesis the analysis of the three farms and farmers was limited to an initial exploration. An in-depth study attempting to produce more categorical answers would

require significantly more resources in terms of time, involvement with the farmers and expertise on different topics. Therefore, there may be information that was not uncovered and that would change the conclusions of this study.

Also, the data collected about the three cases is uneven. The author lived in Ridgedale for at least four weeks during the study and had the chance to interview Richard three times formally and more informally, which provides a good idea of the workings of the farm. The access to production and financial data was more incomplete, but estimations were still possible. The information available about New Forest Farm, though second hand, is mostly concise and available in "Restoration Agriculture" and in a few interviews, both of which are recent. This made a systematic and up-to-date inquiry relatively easy to perform. The production and financial information about Joel and Polyface, though detailed some topics, is dispersed in several books and interviews that span more than fifteen years. Joel also webs production and financial data with political and ethical views, which makes it more difficult to assemble information in a systematic way.

Even if it was possible to visit Ridgedale, the study is heavily based on the testimonies of the farmers, as no independent surveys (e.g., of soils, nutrient balances, animal health, etc) was conducted. There is no reason to suspect that the information provided is not true to the best knowledge of the authors, their emotional attachment to their farms may cause them to cast their stories in a positive light.

Also, although heuristics and observation provide much valuable information, , periodic detailed measurements are important understand long-term tends (e.g., salinity, nutrient depletion).

### Alternative interpretations

Even if the information collected points to the conclusions drawn, it is important to bear in mind the limitations mentioned above and alternative interpretations of the data. Many of these were already mentioned in the analyses and discussion above, but are summarized in the following lists.

#### *These farms are not as successful as they claim to be*

This happen if a combination of different hypothesis is verified:

- When all is taken in account, their productivity is lower than conventional systems. Because a detailed comparison of production was not conducted, this cannot be ruled out;
- Their financial success is due more to no-production activities (education, consulting, speaking). This is currently the case of Ridgedale (though, as mentioned, without education costs would be lower and the production would receive more attention) and account details for New Forest Farm and Polyface are not available;

- Their success depends on the availability of cheap labor from apprentices and interns. Detailed analyses are needed to understand their contribution and cost;
- They are not as resilient as the authors claimed as they were not tested severely enough. Though this may be true in the case of Ridgedale, it is harder to be thought of regarding NFF or Polyface which have been operating for longer;
- The improvement in soil and pastures is dependent on high nutrient imports in the form of feed, or masks other externalities such as declines in micronutrients that are not being replenished. Because proper nutrient balances and soil tests were not performed, this hypothesis cannot be ruled out.

*Their success is not as replicable by others as they claim*

This happen if a combination of different hypothesis is verified:

- Their success depends on being pioneers able to charge high premiums. The market for direct selling or high priced goods is small, and further entrants will erode profit margins;
- Their models are so knowledge intensive that would only be replicable by a small number of people. Others that lack many of their skills will struggle to make a profit. A good way to research this would be to follow ex-interns and ex-apprentices that have gone out to start a farm of their own;
- In addition to being skilled, they were lucky and their success reflects survivorship bias. Others equally skilled tried but had modest results or failed;
- The number of people that would actually like the lifestyle their work entails is smaller than the number of people that read their books and attend their courses and speeches;
- There are elements not mentioned in the books, perhaps not even acknowledge by the authors, which is decisive for their success;
- Transposing their models to different climates/contexts would require adaptations that would compromise their productivity, profitability or socio-environmental benefits.

*Their interest for further research and policy is limited*

This happen if a combination of different hypothesis is verified:

- Similar methods have been sufficiently documented in literature not revised in this thesis;
- Obtaining good conclusions is inherently hard or requires too much resources;
- There are other avenues of research that are more promising at the moment;

# 6.CONCLUSIONS AND FUTURE OUTLOOK

This thesis explored if the approaches of farmers reporting their success with highly diversified farms should be receive more detailed attention from researchers.

Finding the sustainability framework commonly used unclear and prone to misinterpretation, this thesis developed a framework to research this question from a different perspective. It analyses farms in regards to their desirability, their 'existential' sustainability (the ability to maintain their main characteristics), their feasibility to be adopted and their appeal to be adopted.

It was found that the selected farmers/authors' work is generally in line with principles in agroecological literature[115,134,154], and take some of them even further – e.g., using different agroforestry techniques and complex leader-follower animal interactions.

The farms presented were deemed to present many desirable features – the potential to produce high quantities of high quality food in a way that rewards the farmer while favoring biodiversity, animal welfare, social cohesion and creating good working conditions. The magnitude of these effects, however, is not known in detail.

The farmers' dedication to improve their lands and the synergies between different subsystems is likely contribute not only to the maintenance of resources and integrity of the farm, but also to its improvement over time. However, here too it is necessary to have a better understanding if this apparent improvement has weaknesses that go undetected or deleterious consequences elsewhere.

These approaches show promise for implementation in different socioeconomic contexts. Importantly, their core principles should be possible both in richer and poorer countries. However, they are demanding in terms of knowledge and dedication to learning. It also remains to be known whether the necessary adaptations would have significant effects in the approaches' productivity or profitability.

The most distinctive feature about these authors and their approaches is their potential to appeal to many current and aspiring farmers. Although difficulties are mention and acknowledge at times, the discourse is framed in a positive, can-do attitude that can motivate both farmers and consumers to lead a bottom-up process of gradual change. Also, the combined emphasis in both productivity (in a wide sense), entrepreneurship, ecological stewardship and community-building has the potential to bridge the gap between businesspeople that look mostly to profits and those who put the environment or community ahead of business considerations.

Both farmers and agroecologists could benefit from more case studies of highly diversified farms. Farmers would benefit from additional credibility and suggestions for improvement while researchers would also benefit of complementing experiments with real-world data that would be costly and take long to replicate in trials.

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# ANNEXES

# ANNEX 1 - CASE STUDY PROTOCOL INITIALLY USED

## Overview

This case study is conducted as part of the final thesis of the MSc. in Agroecology at NMBU (Norway). Its objective is to critically explore the approaches proposed by different farmer-authors to create ecological and profitable farm enterprises and discuss their contribution to a better agriculture, food system, and society.

More specifically, it analyzes whether the practices used promote the conservation, build-up or regeneration of critical resources such as soil fertility, water availability, knowledge and genetic diversity. I discusses if the strategies used are conducive desirable outcomes both for the farmer (a fulfilling job, a pleasant place to live and a decent income) and to the community and society at large (abundant, affordable and quality food, creation of good working conditions, animal welfare).

## Hypothesis studied

This case study explores the hypothesis that agroecologists and aspiring farmers should pay closer attention to the proposals advanced by farmer-authors for ecological farm enterprises that improve the landscape and community while making a profit.

This case study is more exploratory in nature than descriptive or explanatory. This means that it does not attempt to provide a conclusive explanation of why or how this can be achieved or to describe each farm and farmer in exhaustive detail. Instead it explores the main characteristics and implications of the philosophies, strategies and practices employed. The goal is to see if the available information suggest that the hypothesis (profitable, regenerating farm enterprises) if true, to what extent it is replicable by others, and what areas require further research.

## Case selection and information collection

The specific cases selected are: Joel Salatin and Polyface Farm; Mark Shepard and New Forest Farm (NFF); and Richard Perkins and Ridgedale Permaculture. Polyface and Mark were selected due to the popularity of their writings and the difference in their approaches (pasture based meat/egg production and diversified agroforestry). Ridgedale was selected for combining both approaches in a smaller area, to provide a European context and due to the chance of visiting the farm.

The study of Polyface and NFF relies on information obtained second hand, mostly through books published by the authors and supplemented with writings and interviews available on their webpages or elsewhere (e.g., youtube.com). If necessary, Mark and Joel will be contacted by email and invited to clarify the analysis of their farms and questions that remain unanswered. The study of Ridgedale is based in the impressions gathered over the 14 days of duration of a Permaculture Design Course (26/09/2015 to 09/10/2015), in two semi-structured interviews over skype and in Richard's comments to the analysis of his farm and approach.

## Considerations on information quality and bias avoidance

The reliance on personal testimonies without independent review of the claims advanced is a potential drawback to the study's robustness. Another potential source of bias is the study

author's (mine) interest and aspiration to one day own a highly diversified and profitable operation and therefore be 'rooting' for the approaches proposed to be feasible and successful.

To prevent these pitfalls, two measures are to be taken: the first will be to frame and review the proposals in light of established evidence in literature or usual practice to triangulate the data; the second, to maintain a skeptical eye and look for the frailties, difficulties or specificities of the proposed approaches, as trying to maintain a virtual 'dialectical' dialogue with the farmer-authors.

### Case study questions

#### Level 5: Questions, conclusions and recommendations, going beyond the study

- (Why) should agroecologists (and aspiring farmers) pay more attention to successful pioneers promoting highly diverse farming enterprises?
  - Do they bring innovative ideas not found in current practices or literature?
  - Is it relevant to look at particular cases instead of generalizable practices?
  - Is it useful to focus on individual influence rather than in national policy (bottom-up vs top-down approaches)?
  - Is it better to highlight radically different alternatives than to look for gradual improvements of current practices?
  - Is it desirable to involve morals and worldviews instead of keeping with 'more objective' practices?
- What specific topics deserve/require more research? What policies are needed? Do proposals from farmer-authors justify significant more attention from researchers?

#### Level 4: Questions asked of the entire study – including information beyond case study

- (Why) would their adoption contribute to a more desirable society?
  - Would it improve quantity and quality of production?
  - Would improve sovereignty and social cohesion?
  - Would it create more prosperous and fulfilled farmers?
  - Would it lead to better working conditions, animal treatment, more support to wildlife and better communities?
- (How) are they able to sustain their main characteristics over the long term?
  - How is the resource base maintained or enhanced?
  - How is resiliency to adverse situations developed?
  - How are customer expectations of price and convenience satisfied (without sacrificing profitability)?
- (Why) do the proposed approaches have potential for widespread adoption?
  - Are they applicable to different eco-regions and biophysical endowments?
  - Are they feasible in different socioeconomic contexts, namely richer and poorer?
  - Are they possible to be undertaken by single farmers autonomously?
  - Do they provide a compelling narrative and appeal for change?

### Level 3: Questions asked of the pattern of findings across multiple cases

- What are the common themes behind the proposed approaches?
- In what do they differ?

### Level 2: Questions asked of the individual case

- What are the most important resources and (how) are they regenerated?
  - Climate / water / soil / genetic diversity
  - Knowledge / skills / social support / personal traits
  - Capital / technology /scale
- (How) is the functional integrity (the structure of different system elements) and resiliency maintained? What degree of autonomy and self-reliance does it provide?
  - Does it foster the participation of different actors and elements?
  - Are features improved in tandem or at the expense of others?
  - Are redundancies and anti-fragility mechanisms built into the system?
  - Does it empower the farmer or create dependence on factors outside his control?
- Does it provide abundant, nutritious and tasty food?
  - Is the system productive in comparison with other approaches?
  - Is there a difference in taste and nutrition?
  - Is it safer than other approaches?
- How rewarding is it for farmer?
  - Is it profitable and well-paying?
  - Are there work hazards or safety issues?
  - Is the job meaningful and fulfilling?
  - Does the work allow for improvement and self-actualization?
- What worldviews and narratives are promoted by the approach?
  - What are the basic pre-conceptions of the farmer? What do they show bias towards? How are they reflected in the farm?
  - How inclusive is the approach to different ideas? What lines are not to be crossed?
  - How does the approach 'sell' itself? How appealing is that narrative?
- What are the broader aims and how does society accepted the approach?
  - How affordable and convenient is it for consumers?
  - Does it create safe, well-paying and rewarding jobs?
  - How does it treat animals and wildlife?
  - Does it create pleasant landscapes and better communities?

### Level 1: questions asked / information collected of specific interviewees

The exact questions asked and information collected about each farm/farmer are presented in chapter 3 and are not presented here to avoid duplication.